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WATER QUALITY INVESTIGATIONS ON THE REYNOLDS CREEK WATERSHED

SOUTHWEST IDAHO, A 3-YEAR SUMMARY

ARS-BLM COOPERATIVE STUDIES

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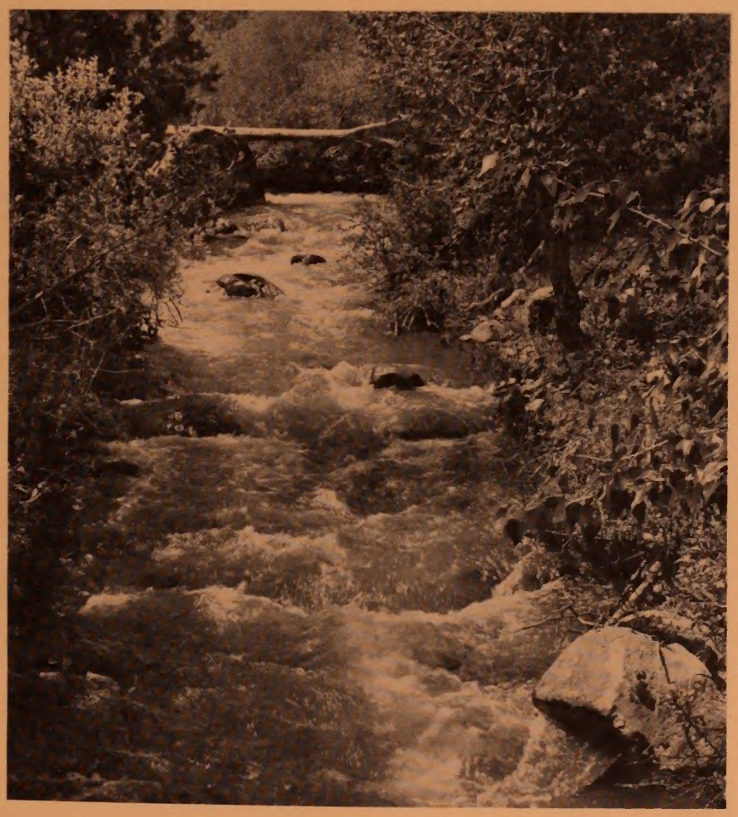

INTERIM REPORT ON WATER QUALITY

COOPERATIVE AGREEMENT NO. 12-14-5001-6028

OCTOBER 1972 THROUGH SEPTEMBER 1975

TO

BUREAU OF LAND MANAGEMENT
U. S. DEPARTMENT OF INTERIOR

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WATER QUALITY INVESTIGATIONS ON THE REYNOLDS CREEK WATERSHED SOUTHWEST IDAHO, A 3-YEAR SUMMARY

By

G. R. Stephenson and L. V. Street

INTRODUCTION

General

In recent years there has been increased use of public range in the western United States for recreational, agricultural, mining, and construction activities. These uses have intensified to the extent that their effects on quality of streamflow have become a major concern to those who manage public lands. Water pollution on rangeland is usually from nonpoint sources. The harsh climate and the vast acreages involved usually preclude control by abatement common to midwest agricultural areas. Thus, few solutions have been provided to comply with high standards of water quality of streams on rangeland watersheds and the result has been increased pollution of these streams.

The Federal Water Pollution Control Act Amendments (Public Law 92-500) (7) provide the framework for establishing regulatory programs to reduce and eventually eliminate pollution in the nation's navigable waters. Basic data are needed, as stated in P.L. 92-500, for developing "guidelines for identifying and evaluating the nature and extent of nonpoint pollution sources".

Water quality data from western rangeland in semiarid conditions, where cattle grazing operations are the major industry, are presently needed by those agencies responsible for management and use of this public domain. The Bureau of Land Management needs this data for use in Environmental Impact Statements. Similarly, the BLM can use this data to develop new grazing allotment plans for improved management practices. Under Section 208 of P.L. 92-500, each state has the responsibility for identifying nonpoint sources of pollution and developing a plan for their control. Water quality characteristics of rangeland are urgently needed for this purpose, also.

The Reynolds Creek Experimental Watershed offers an excellent opportunity to determine water quality problems that may be associated with rangelands. Since no commercial fertilizers have been used on the watershed, herbicides have been used infrequently for sagebrush control, and the only broad application of insecticide on the watershed was an aerial application of malathion in July 1975 for grasshopper control.

Water quality parameters can be measured and related solely to grazing practices. Also, with the distribution of hydrologic monitoring networks throughout the watershed, water quality constituents can be related to rangeland watershed hydrology.

When determining pollution sources on rangeland, it becomes necessary to separate superimposed, man-made effects of different land use practices from natural variations in water quality. This can be expensive and difficult, but necessary, for those agencies who regulate and administer land use practices on public domain. In this report we have tried to isolate the effects management practices--cattle grazing operations and irrigation--have on the quality of streamflow on the Reynolds Creek Watershed. In the process, however, the effects naturally occurring phenomena have on quality of streamflow are also determined.

The results of this work will aid in the development of better management practices through the identification and quantification of nonpoint sources of pollution on rangeland. Only through a better understanding of the magnitude and scope of water quality parameters for rangelands can the presence or absence of a water quality problem be determined. The source data can provide insight into management practices and effects on water quality parameters. It is only through the application of basic data to development of improved management practices that downstream water quality can be improved.

Objectives

The general objective of this research is to determine the water quality characteristics of streamflow of the Reynolds Creek Watershed. The specific objectives are to determine water quality characteristics as influenced by:

1. Livestock operations under various management practices,
2. Irrigation return flow, and
3. Natural soil, geologic, and vegetative conditions.

Also, it was considered important to determine sources of nonpoint pollution and make feasible recommendations for control of nonpoint sources.

Scope of This Investigation

This report is a summary of three years' investigation of the water quality characteristics of the Reynolds Creek Watershed. The research was initiated by ARS at the request of the BLM through cooperative research agreements. Water samples were collected to determine the physical, chemical, and biological properties of Reynolds Creek water and its

tributaries on regular schedules and according to climatic and land use conditions. A summary of data collected during the course of this investigation is found in the Appendix.

Description of Study Area

The Reynolds Creek Experimental Watershed*, located in Owyhee County, southwest Idaho, encompasses 23,390 hectares and ranges in elevation from 1068 to 2227 meters, msl. Hydrologic investigations have been conducted by the Agricultural Research Service on this watershed since 1961. Streamflow is measured at the watershed outlet and at major tributaries by permanent structures. Precipitation and other climatic parameters have been measured continuously throughout the watershed.

The watershed is predominantly sagebrush rangeland, typical of the intermountain west, where cattle operations are the major industry. Approximately 810 hectares of cultivated fields are irrigated by streamflow for hay production.

Soils of the watershed are mostly residual, being developed from the underlying geologic parent material of volcanic rock, granite, and lake sediments. Soil thickness and horizon development vary directly with elevation, slope, aspect, and climatic conditions.

The vegetative cover on the rangeland portion of the watershed consists of approximately 95 percent sagebrush with an understory of assorted grasses. Approximately 2 percent of the cover is intermittent stands of Douglas fir and Aspen, and 3 percent of the area contains permanent irrigated alfalfa fields. Canopy cover on the rangeland varies from 0 to 75 percent.

LITERATURE REVIEW

Many rangeland water quality investigations reported in the literature have reported on bacteriological indicators in streams from high mountain watersheds. Several of these studies (5, 6, 9, 10, 12, 13, 14, 16) have related bacterial quality of streamflow to various land-use practices and streamflow characteristics. The results of these investigations, although varied, were that livestock grazing, public use, high runoff, irrigation return flow, and seasonal use, all frequently increased bacterial concentrations.

Only one investigation of bacteriological indicators on lower elevation, semidesert rangeland conditions was found in the literature. This study (3) was on a chained and seeded pinyon-juniper range site

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* Unpublished Brochure: Northwest Watershed Research Center, USDA, ARS, Western Region, P. O. Box 2700, Boise, Idaho 83701.

in Utah, where runoff was produced by rainfall simulation. It was concluded that the potential public health hazard of livestock grazing on open range on gentle slopes was minimal. The authors found that fecal and total coliform concentrations in the runoff did not change significantly from grazing cattle at the 2 ha/Animal Unit Month (AUM) grazing level.

One additional investigation (11), related to rangeland cattle operation, attempted to evaluate the impact of winter feeding practices on the quality of waters adjacent to such operations. The result of this work concluded that the winter feeding operation had a significant, but short-lived affect on the bacterial quality of the streams.

Several rangeland water quality investigations have related variation in chemical quality parameters of streams to flow condition and land use (3, 5, 9, 11, 13). Results from several of these investigations concluded that livestock operations, such as grazing and winter feeding, had little effect on chemical quality of the streams (3, 11). However, other land use practices, such as fire and closing areas to all but big game herds, were found to increase ionic concentrations (6, 9, 14). One investigation (12) found overland flow to be the largest single factor in causing chemical variation, while another (9) study located at a higher elevation in the same drainage system, found no appreciable changes in dissolved solids related to streamflow or land use.

Sediment generally makes up the greatest volume of polluting material in streams. It is no surprise then, that most of the literature on rangeland pollution is concerned with sediment studies as nonpoint sources of pollution. Unregulated and excessive grazing has caused excessive yields of sediment on much of western rangeland (2). One investigator (4) on the subject states that, "the literature abounds with references to floods after overgrazing". However, the present authors found many references to overgrazing vs. sediment production to be coupled with natural or man-made disasters, such as 100-year high-intensity summer thunderstorms or fire. The literature is still lacking in water quality investigations on land use practices and sediment production on hydrologically instrumented rangeland watersheds. Studies in Utah, Idaho, Colorado, New Mexico, and Montana all relate to overgrazing--the depleting of natural vegetation, litter, and excessive soil compaction--as the most important factor contributing to erosion.

FIELD PROCEDURES

Description of Sampling Sites

Throughout the course of this investigation, a total of 23 sites were maintained and sampled on the Reynolds Creek Watershed. Samples for bacteria analyses were collected on weekly schedules during the grazing season and at less frequent intervals during the nongrazing season. Samples for chemical and sediment analyses were collected biweekly to monthly.

Additional sites, or more frequent samples at regularly scheduled sites, were used to determine water quality variations during the major runoff events. Table 1 gives a description and sample record of the regularly scheduled sampling sites. The location of all sampling sites can be found on Figure 1. The sample record varies at some sites, because of freezing over during winter or intermittent streamflow during late summer.

TABLE 1.--Description of sample sites

Location Site No.	Sample Record	No. of Samples	Site (*) Characteristics	Grazing(+) Record
1	11/26/73-9/22/75	51	P	A
2	11/26/73-9/22/75	50	R	E
13	4/22/75-9/22/75	15	R	B
12	5/27/75-6/24/75	4	R	B
11	6/10/75-6/24/75	3	R	C
9	6/16/75-7/7/75	2	R	C
3	10/19/72-9/22/75	77	M	A
4	4/23/74-9/22/75	56	R	E
10	6/16/75-9/22/75	6	R	C
8	4/8/75-9/22/75	16	R	C
6	4/29/74-4/22/75	35	M	A
7	4/14/74-7/22/75	13	M	A
5	10/19/72-9/22/75	77	P	A
14	10/19/72-9/22/75	57	P	A
15	10/19/72-9/22/75	74	P	A
16	4/23/74-9/22/75	55	R	E
17	10/18/72-9/22/75	77	R	E
20	10/18/72-9/22/75	74	R	D
19	4/23/74-9/22/75	57	R	D
18	10/18/72-9/22/75	57	R	D
21	12/19/72-9/22/75	66	R	D
22	12/10/72-9/22/75	49	R	D
23	1/29/73-9/22/75	49	R	D

(*) Description of land use activities immediately above sampling site: P - pasture; R - range; M - mixed pasture and range.

(+) Approximate periods of time that cattle are located upstream from sampling site: A - continuous; B - April-May; C - May-June; D - June-October; E - April-October. Effects of grazing by deer, wild horses, and other wildlife were not studied.

All regularly scheduled sampling sites on the watershed were located close enough to continuous flow measuring devices so that the streamflow factor could always be determined. The location of all hydrologic and meteorologic instrumentation located on the Reynolds Creek Watershed is given in the Research Center Brochure.

Sampling sites were selected to represent the effects of naturally occurring range conditions, grazing, and management practices, on water quality of streamflow. Channel characteristics were considered to be acceptable if the gradient and roughness did not exceed the mean for the channel segment between the present site and the next site upstream. Channel roughness was generally determined by observation.

Sampling Methods

Water samples for bacteria analyses are collected in 160-ml wide-mouthed, pyrex bottles, from the top 5 cm of the stream. All sample bottles are thoroughly cleaned and autoclaved prior to being taken to the field. Samples are placed on ice until arrival at the laboratory, where they are refrigerated. All samples are prepared and incubated within 24 hours of collection. Chemical samples are taken in plastic, 1-liter, containers at 5 to 8 cms below the water surface. Temperature, dissolved oxygen, and conductivity are determined at each site for each sample taken. Sediment samples are taken in 500-ml bottles, with the mouth elevated about 8 cms above the stream bottom. Samples are taken by hand during very low concentration, and with a HD-48 sampler during higher sediment concentration.

LABORATORY PROCEDURES

Bacterial counts are determined according to prescribed methods (1), using the membrane filter technique. M-Endo and M-FC media are used for total coliform and fecal coliform determination, respectively, and M-Enterococcus agar used for fecal streptococci determination. Standard plate counts are determined, following prescribed incubation periods for each test, and reported in counts per 100 ml of water.

Total suspended solids are determined by passing a 200-ml sample through a glass fiber filter, using a standard filter membrane-vacuum procedure. The filters are first washed with distilled water and dried at 105° C and cooled in a desiccator before the sample is passed through. After the sample is filtered, dried, and cooled, the filter is reweighed to determine the collected residue. The results are reported in milligrams of suspended solids per liter of water.

All chemical analyses are done according to Standard Methods (1), by the Bureau of Reclamation, USDI, Regional Water Lab, Boise, Idaho, under a cooperative agreement. The results of each set of samples are reported directly to the Research Center.

DISCUSSION OF RESULTS

Bacteriological Investigations

Bacterial variations under limited grazing control--Data from three sampling sites are used to illustrate variations in source and concentrations of bacterial pollution from parts of the Reynolds Creek Watershed under limited grazing control. These three sites, 22, 21, and 18, are located along channel segments on open range, at elevations of 2019 m, 1670 m, and 1463 m, respectively.

Figure 2 gives variations in total and fecal coliform concentrations and a streamflow hydrograph for each of the three sites. The bacterial concentrations are plotted on log scale for a running average of counts for all sampling dates. The streamflow hydrograph is given for daily averages in cubic meters per second.

Site 22 is located on a small drainage in sagebrush rangeland, within a fenced area grazed by approximately 500 cattle from July through October. The number of cattle grazed may vary from year to year, depending on grazing conditions and operator's plans. The site is generally snow-covered from November through May.

The affect the presence of cattle has on bacterial concentrations of the stream at this site is quite pronounced. Fecal coliform concentrations increase rapidly as soon as cattle are moved into the area in early July, as seen in Figure 2, and remain high until after the cattle are removed.

Peak streamflow, resulting from snowmelt, occurs during April-June and has little affect on concentrating bacteria colonies. The heavy snow cover probably prevents any transporting of bacteria from the soil surface by overland flow into the channels during the winter months to be carried away by spring runoff. Most of the fecal colonies, resulting from the previous year's grazing season, have been flushed out of the channel or died off by spring snowmelt time.

During dry years in late summer, such as 1973 and 1974, the stream at this site may dry up and stockwater is provided by a spring and pond. The bacterial concentrations remain high following recurrence of streamflow. In fact, the highest fecal count for 1974 was recorded soon after resumption of flow, which drains the stockpond area. The only other direct relationship between runoff and bacterial concentration at this site occurred prior to grazing in late March - early April 1975, during a warm, rainy period, resulting in increased flow. Total coliform concentrations increased over a 2-week period, but decreased rapidly thereafter. Fecal colonies were low and constant.

After cattle are removed from the area in late fall, residual colonies from both bacteria groups remain high for almost three months, while the streamflow flushed the colonies out of the channel. It is assumed that the colonies remain viable in this environment well into the winter months, until snow cover and colder temperatures considerably reduce bacterial input from the upland soil surfaces.

Site 21 is located in a narrow canyon near the center of a large grazing area in which over 900 cattle graze from June through September. The stream gradient is high and the channel very rough immediately above this site. The general bacterial trends are the same as for site 22, except considerably reduced in concentration. This is probably the result of aeration, which "self-purifies" the water as the stream flows over rapids and small falls for approximately 3.5 km upstream from the site.

Bacteria data from site 18 indicate a longer grazing season above this site than at the previous two sites. The extremes of maximum concentrations occur at about the same time. However, several conditions within the area above this site cause periodic increases in bacterial concentrations not found previously. First, large stands of cottonwood trees occur along the channel where cattle congregate for shade. Concentrations of both bacteria groups and suspended sediment increase relative to this situation. Second, during fall roundup, cattle are concentrated in holding corrals adjacent to the channel just above this site and peak fecal coliform concentrations in the stream occur almost immediately. Approximately 1000 cattle graze in the area above this site from late June to mid October.

Bacterial variations under winter feeding operations--Data from two sites, 5 and 3, reflect the presence of cattle in winter feeding pastures. These two sites are located along the main channel of Reynolds Creek adjacent to irrigated pasture where cattle are fed from October through March of each year. Runoff from these fields flows directly into Reynolds Creek. Approximately 2000 cattle are fed in these winter pastures, with 100-500 cattle in 20-120 ha fields at any one time. These sites are more susceptible to runoff from storm events and irrigation, which flush bacteria from the fields into the stream. Figure 2 shows that peak bacterial concentrations are more directly related to runoff events at these two sites than was the case at the sites on open range. Very little snow cover occurs at these two sites and the ground surface is frozen during most of the winter months, enhancing runoff and the flushing effect. The effect of irrigation return flow washing bacterial colonies off the soil into the stream is evident from April through August in some fields.

The peak bacterial concentrations at sites 5 and 3 during early fall, reflect the return of cattle to these fields from open range. Bacterial concentrations remain high during the winter feeding season and

are lowest during the summer, when cattle are moved to open range. Several operators feed calves and a few horses in these pastures during summer months, which accounts for increased bacterial concentrations at this time, especially during 1975.

Bacterial variations under a detailed grazing management plan--The Bureau of Land Management's Reynolds Creek allotment management plan for the 1975 grazing season incorporates more detailed management into the grazing system on a portion of the Reynolds Creek Watershed (15). Prior to the application of this plan, the area received heavy use by 20 operators as cattle were allowed to graze from lower to higher elevations as the season progressed. The new plan uses a deferred rotation grazing formula, designed to improve range conditions and stabilize livestock production consistent with other multiple resource values. The allotment is broken up into seven fenced fields, with early spring grazing in three fields and deferred grazing in others until summer or early fall. These treatments will vary from field to field on a 4-year rotational basis.

To determine the effect that a strict management plan such as this might have on the bacterial quality of streamflow, six sites were monitored in two fields during the grazing season. Sites 12 and 13 were located in the Soldier Cap field, used for early spring grazing, and sites 8, 9, 10, and 11 are located in the Salmon Butte field, which was used for early summer grazing. Figure 1 gives location of these sites and the two allotment fields. Approximately 1050 cattle, from five operators, were grazed in these fields during the allotted times before moving into adjacent fields. A small number of mule deer and approximately 32 wild horses also graze in the area (15).

The original allotment plan, when fully implemented, calls for grazing in the Soldier Cap field from May 1 to May 15, and in the Salmon Butte field, May 15 through June 15. Because of incomplete fencing during this first year, the cattle were not kept strictly in their designated fields at all times.

A composite of 46 samples collected at the sites in each allotment is given in Figures 3 and 4. Fecal coliform bacteria is used to illustrate the changes, because it is the best indicator of bacterial pollution from warm-blooded animals, although coliform and fecal streptococcus concentrations were determined, also. Samples were taken weekly from April 22 through September 22. As seen in Figure 3, Soldier Cap allotment, no fecal counts were recorded from April 22 until approximately May 15. Concentrations became high and remained high through June 24. By July 7, the concentrations were nearly zero.

Figure 4 shows the same characteristics for the Salmon Butte allotment. No fecal counts were recorded until June 3, and started decreasing rapidly after June 24.

On July 21, a high-intensity summer storm passed through this area, causing considerable runoff. As seen in Figure 3, the "flushing" effect of the runoff resulted in concentrating the residual bacteria into the stream even though the cattle had been out of the area by as much as 3 weeks.

These data indicate that the introduction of cattle into these new management allotment fields, even for a short period of time, has a very sudden effect on bacterial quality of the streams. Bacterial concentrations in the streams are reduced rapidly after the cattle are removed, but residual colonies remain along the streambanks and in the soil, and are subject to flushing into the streams for some time afterward.

Bacterial variations during streamflow--Detailed sampling was done for bacterial analyses through several runoff events from snowmelt. Analyses of these samples show that considerable variations in coliform concentrations occur during changes in streamflow. Figure 5 gives the results of data collected during two peak flow events at site 15. Both total and fecal coliform counts increase rapidly as the water level rises in the stream channel. On May 1, peak concentrations for fecal coliforms occurred about 1 hour before peak concentration for total coliforms, and about 2 hours before the hydrograph peak. The relative situation was identical on May 3, except that the hydrograph peak occurred about 4 hours later. These same relationships have been found to occur at other sites during similar runoff events on the watershed, and show a close similarity to suspended sediment concentrations and streamflow during snowmelt runoff.

The bacteria are concentrated by the increase in flow up to a critical limit where the concentrations are then decreased by dilution as streamflow continues to rise. The variability in bacteria concentration, resulting from streamflow, is an important factor to consider when samples are taken, particularly if the results are used for checks with water quality standards.

Bacterial indicators and water quality standards--Indicator organisms are used to determine the bacteriological quality of water. Since it is the kind of bacteria present in water, rather than the total number, the danger lies in those pathogens spread mainly by fecal contamination. Any water contaminated with fecal matter contains enteric pathogens and is, therefore, polluted. Fecal contamination is established by the presence of organisms, which live in feces, never free-living in nature. The indicator organisms used in the U. S. is *Escherichia coli*. When the bacteria *E. coli* is found in a water it is sufficient evidence that fecal contamination has occurred and that enteric pathogens may be present.

The standard bacteriological test used for most waters is the total coliforms test. However, within the total coliform group species of bacteria other than *E. coli* may be present, which occur not only in fecal materials, but occur naturally in soils and plants. Feasibly, then, a total coliform test could give a high plate count and not contain fecal contamination. This disadvantage is particularly important when evaluating waters from agricultural lands. Because of this possibility, the fecal coliform test is used as these bacteria, predominantly *E. coli*, are associated only with the feces of warm-blooded animals.

Most water quality standards specify total coliform and/or fecal coliform as parameters to use when evaluating surface water. Idaho standards use both parameters. Because of the inherent problems that may exist in the total coliform group, fecal coliforms were used in this study to evaluate the bacteriological quality of Reynolds Creek.

The surface water of Reynolds Creek falls under the classification of Secondary Contact Recreational Waters, by the Idaho Department of Health and Welfare (8). Data from two sites along Reynolds Creek are used to illustrate the bacteriological quality and to compare it to Idaho's water quality standards. Site 3 is located at the outlet of the watershed and site 1 is located about 45 m above the confluence of Reynolds Creek and the Snake River (Figure 1). As the Snake River is one of Idaho's major waterways, it seemed advisable to include this data as an indication of what might be expected from a tributary draining primarily rangeland conditions. The latter site, however, is influenced considerably by year around grazing in fields adjacent to Reynolds Creek.

For secondary contact recreational waters, Idaho standards specify that for any single sample the concentrations of fecal coliforms shall not exceed 800 counts per 100 mls of water. Figure 6 illustrates that for 77 samples over a 3-year period, the standards were exceeded 8 percent of the time for site 3. Figure 7 shows that standards were exceeded 21 percent of the time at site 1.

The same analyses were made for sites 17, 18, 21, and 22, all on rangeland, upstream from the irrigated fields, where winter feeding is conducted. The results are that over the 3-year period, average of 68 samples, the standard was rarely exceeded at any of these range sites. This seems to indicate that the source of bacteria pollution is coming from winter feeding operations where cattle are concentrated in fields along Reynolds Creek.

Figure 8 also supports this conclusion. Data in this figure show that at sites 15, 14, and 5, located along Reynolds Creek adjacent to irrigated fields where cattle are concentrated for winter feeding, the bacteria counts are much higher. Site 3 is located on rangeland, but

The site occurs immediately downstream from winter feeding pasture and shows this influence. Site 22 is also located on open range, but is situated in a small drainage area where cattle concentrate for water. Consequently, even on open range, bacterial pollution may be significant, depending on local conditions.

Water Chemistry Investigations

Variations in chemical constituents of streamflow in the Reynolds Creek Watershed are mainly related to irrigation return flow and snowmelt runoff.

The most significant changes in chemical concentrations of water in Reynolds Creek occur along the lower reaches of the watershed where irrigation return flow occurs. To illustrate these changes, data from two sites are used--site No. 17 on open range with no irrigation return flow and site No. 5 in the irrigated area of the watershed where irrigation return flow dominates during the summer. Figure 9 gives concentrations of the major chemical constituents for site No. 17 and for site No. 5.

To show changes in chemical concentration due to irrigation return flow, data from April through October 1974 are used. Figure 9 shows the increase in concentrations occurring at the irrigated area, site No. 5, as compared with the rangeland area, site No. 17. One reason for this difference is that, because of longer time in residence, chemical concentrations normally increase downstream. However, the data do not indicate a gradual downstream increasing trend in concentrations; rather a rapid increase occurs as soon as the stream enters the irrigated area. The major change occurs in July, when return flow is maximum, and the most significant ions are calcium, magnesium, sodium, and chloride. This is probably the result of these soluble ions being flushed from the irrigated fields. Sulfate also increases considerably, which probably results from the change in geologic material (evaporites in lake sediments) over which the stream flows.

The second explanation for increased chemical concentration is the decreasing streamflow during the irrigation season, making the ionic concentrations per volume of water higher. Streamflow in the lower reaches of the watershed during late summer and early fall originates mainly from irrigation return flow and baseflow.

Both explanations describe processes, which contribute to reduced quality of Reynolds Creek water during the summer and early fall months.

The sodium adsorption ratio (SAR), an alkali hazard index computed, using sodium, calcium, and magnesium concentrations, indicates that the water at site No. 5 is not dominated by sodium and has a low alkali hazard (Figure 9). There is, however, an increase in salinity during the irrigation season, which is indicated by the increased conductivity (EC) measurements, shown in Figure 9.

Figures 10 and 11 show the average monthly hydrograph and total dissolved solid and nitrate concentrations for sampling dates over a 3-year period at Sites 5 and 17, respectively. Data from Figure 10 show that at Site 5, the total dissolved solids vary inversely with streamflow, indicating that increased streamflow dilutes the total ionic concentrations. Nitrate concentrations, except for the late summer--early fall of 1974, vary directly with streamflow. The only explanation for this anomalis occurrence in 1974 is that increased irrigation of an alfalfa field adjacent to the stream channel at this site may have resulted in flushing soluble nitrate into the stream.

Data from Figure 11, Site 17, show that dissolved solids vary inversely with streamflow and nitrates inversely throughout the entire period of record. Total concentrations of both TDS and nitrate are much lower than at Site 5.

Data from Figures 9, 10, and 11 show that the chemistry of the stream responds rapidly to changes in the hydrograph, and slowly but consistently, to changes in irrigation return flow. One additional observation is that the soluble chemical components of the stream, such as nitrate, return closely to base flow levels when runoff diminishes.

Because of the low values of nutrients at most of the rangeland water quality sampling sites, there appears to be no evidence that livestock grazing contributes to deterioration in the chemical quality of Reynolds Creek water.

Suspended Sediment

The major portion of sediment studies on the Reynolds Creek Watershed fall under the program title, Sediment Yield and Runoff From Rangeland Watersheds. Under this program, sediment measurements are being related to hydraulic and hydrologic properties of streamflow and also to watershed characteristics, such as soil, vegetation, and range management. Sediment yield and erosion models are being developed and tested.

Under the water quality program, samples for suspended sediment were taken at regular intervals, along with samples for chemical analyses. Detailed sampling for suspended sediment analyses taken through major runoff events were taken as part of the sediment research program. Most water quality sediment samples were taken at lower flows and augment the Sediment Yield Program.

Appendix I gives the annual range of values of suspended sediment by sampling site for each of the 3 years of the sampling period. In addition, Table 2 gives the average monthly yield of suspended sediment at Sites 17 and 3 (Figure 1).

TABLE 2.--Suspended Sediment Yield*

Site 17 (Tollgate)**

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Yearly Total
1973	5	6	25	81	2	9	679	254	5	1	1	1	1069
1974	1	2	2	460	12	940	376	565	60	5	1	1	2425
1975	1	6	4	6	59	99	160	3449	1663	46	1	1	5495

Site 3 (Outlet Weir)***

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Yearly Total
1973	4	9	25	37	12	22	2237	25	7	4	4	2	2388
1974	2	4	12	1420	23	3804	350	148	115	6	4	2	5890
1975	6	7	9	169	1830	937	274	4065	1870	199	4	2	9372

* Metric Tons
** 54.44 km^2
*** 233.72 km^2

Sediment yield determinations on the Reynolds Creek Watershed show that 5 to 10 percent of yearly streamflow transports 50-90 percent of yearly sediment yield during only a few days. Over the 7-year period of sampling, sediment yield is increased about ten fold from dry to wet years.

No evidence was found from either the Water Quality or Sediment Yield investigations to indicate that the present grazing programs on Reynolds Creek are responsible for accelerated erosion rates. Major storm events and flood flow during snowmelt runoff are the major contributors to erosion and sediment yield.

SUMMARY AND CONCLUSIONS

Bacterial nonpoint source pollution over a 3-year period was evaluated to determine source and quantity on a rangeland watershed in southwest Idaho.

When cattle are free to graze large segments of rangeland with a low level of management, their presence directly affects the fecal coliform concentration of the streams. Maximum fecal coliform concentrations were recorded at channel sites on open range soon after the cattle were moved onto the range, and remained high from several weeks to 3 months after removal. Fecal coliform concentration increased from zero to 2500 counts/100 ml at several sites.

The relationship between coliform counts and hydrologic characteristics was quite varied. Runoff from rainstorms increased coliform numbers in both range and irrigated pasture conditions with total coliform counts being more sensitive to this phenomena than were fecal coliform counts. Snowmelt runoff had little effect on concentrating the bacteria of either group on open range and, in many cases, had a dilution effect. Irrigation runoff from pastures caused both fecal and total coliform counts to increase in segments of adjacent streams.

At sites on open range, where channel flow is intermittent during the summer, some of the highest coliform concentrations were counted.

After flow resumed, both total and fecal counts remained high for several months, probably as a result of flushing from the channel as the water level increased. At all sites, streamflow volume was more closely related to total than to fecal coliform concentrations.

Coliform concentrations were observed to decrease along channel segments with steep gradients and increased roughness. Environmentally related factors within the stream, such as aeration of the water moving through the rougher channel segments and ultraviolet rays from solar radiation, may have contributed to self-purification. The precise effect these parameters have on bacterial survival in natural waters is only speculative.

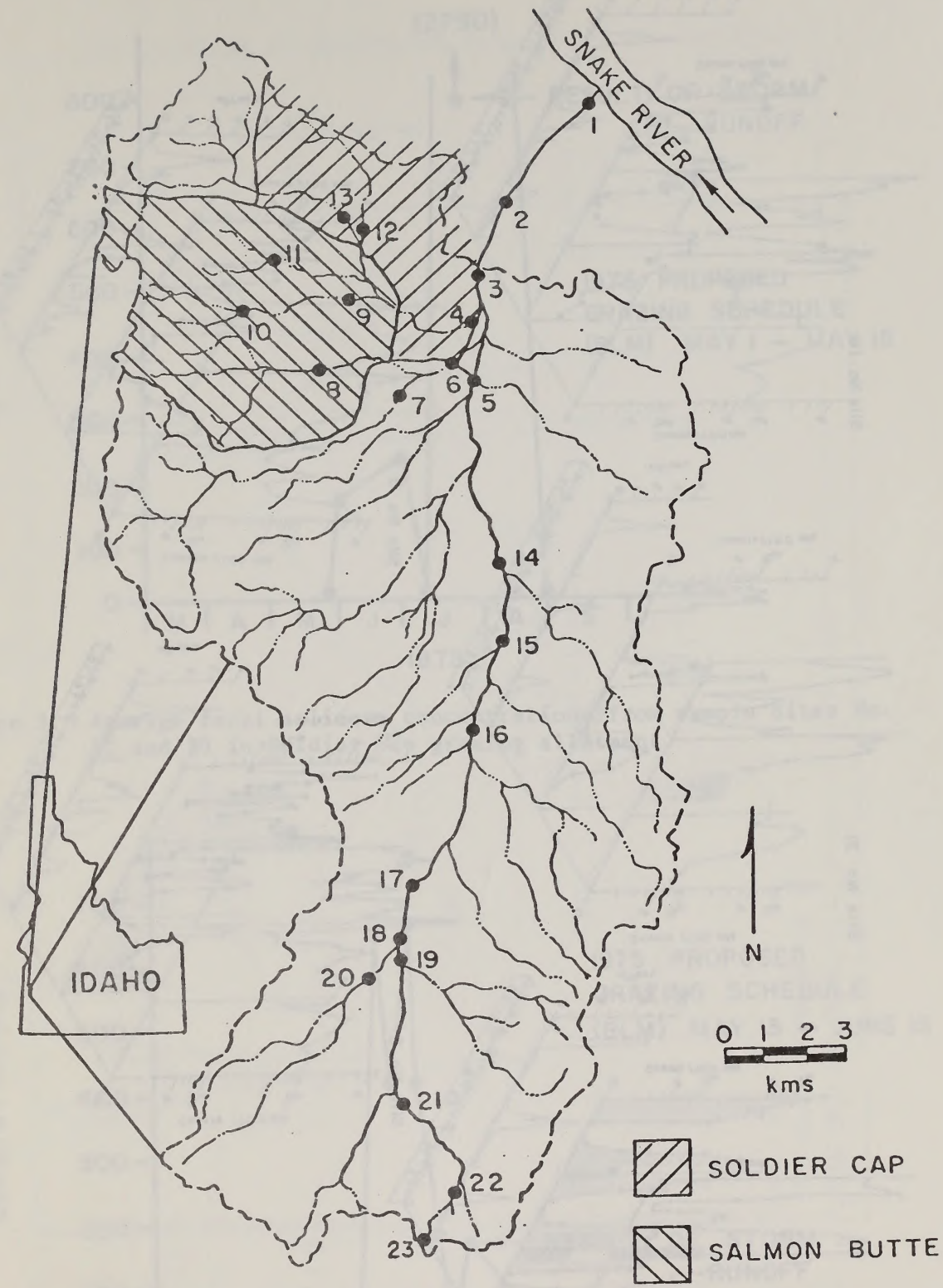
Coliform data collected from sites located in fenced allotments, where deferred grazing management was practiced, showed that the introduction of cattle into these fields caused fecal coliform concentrations to suddenly increase and then, after the cattle were removed, decrease rapidly. Residual organisms remained in the soil and adjacent to the channels for some time.

Typical rangeland cattle operations will probably result in coliform bacterial pollution along various reaches of the streams draining rangeland; however, these bacterial concentrations will vary according to the number of cattle and their access to streams, physical, and hydrologic characteristics of the flow regime and climatic conditions. Continuous monitoring of streams under these conditions will probably show fecal coliform counts frequently in excess of water quality standards. This is even more likely for runoff from pastures during winter feeding operations.

The following management practices should be considered for improving downstream water quality from the upstream grazing practices described in this paper. For livestock grazing on rangeland, greater emphasis should be given to: 1) developing springs and shade upland, away from the free-flowing streams; 2) transporting water for livestock by pipeline or ditch from streams or wells, to remote sites away from streams; 3) salt and mineral blocks should be located in upland areas away from streams; and 4) livestock should not be concentrated in holding corrals adjacent to streams. For livestock winter feeding operations on irrigated pasture and hay fields, holding ponds can be developed at lower end of field to increase infiltration, thereby reducing runoff directly into streams, and buffer zones of heavy vegetative cover between lower end of fields and adjacent streams can be used to increase infiltration and reduce runoff.

One rangeland subwatershed on Reynolds Creek has already been equipped with a large spring development to water two grazing allotments. After one grazing season, observations indicate a decrease in bacterial indicators in the streams draining these allotments. Monitoring of these streams over several grazing seasons will be needed before results can be conclusive. The effects of vegetative buffer zones and holding ponds in reducing bacterial contamination from irrigated pastures and hay fields used for winter livestock feeding, are presently being evaluated.

Management practices, which are most practical and fit best into each local situation, should be determined and incorporated into the grazing management plan.



GRAZING ALLOTMENTS

Figure 1. Index map of water quality sampling sites and to grazing allotments, Reynolds Creek Watershed.

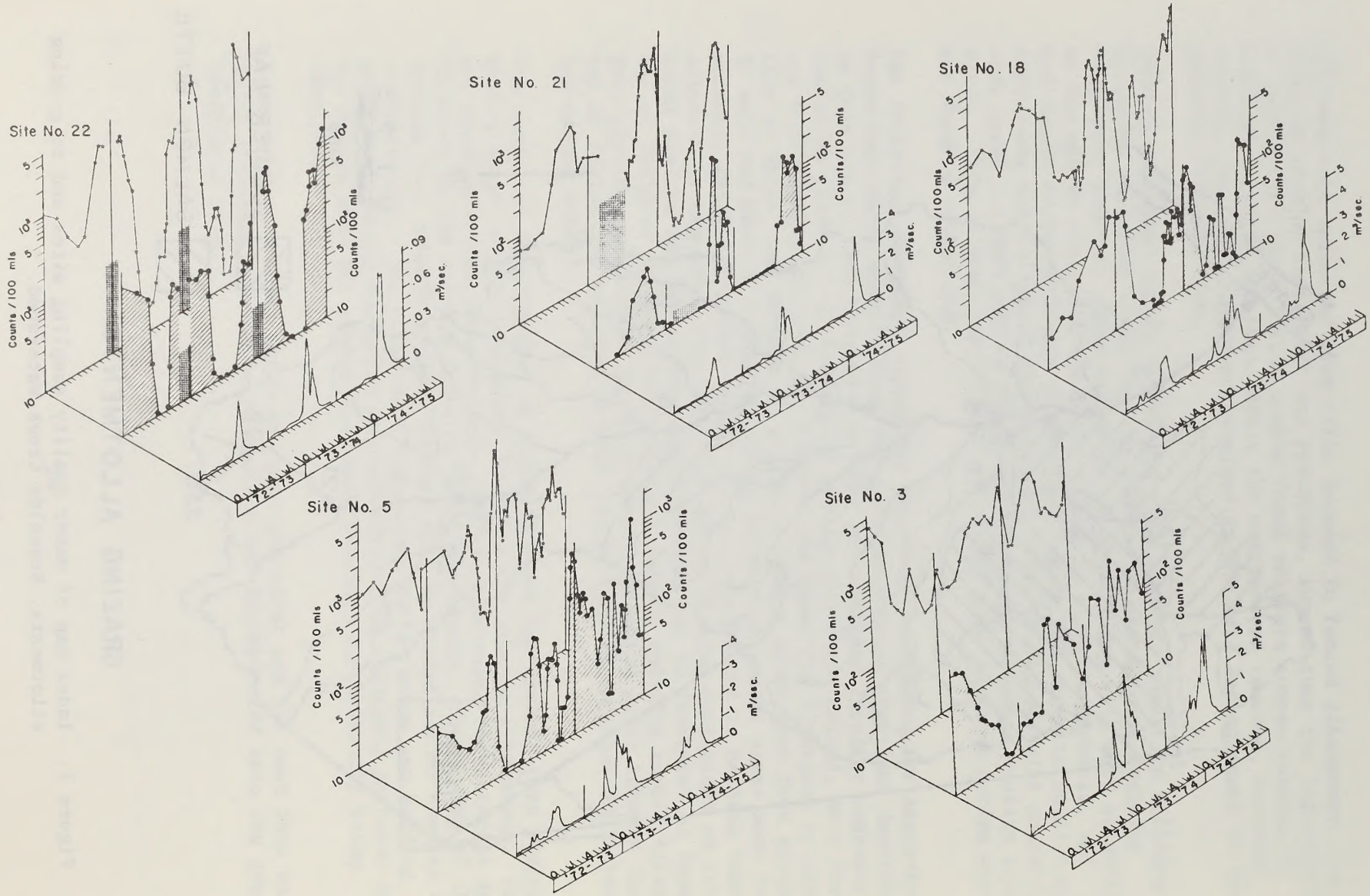


Figure 2. Bacterial variations and streamflow regime along Reynolds Creek. Stars (☆) over unshaded area points for total coliform concentrations, black dots (●) over shaded area for fecal coliform concentrations and solid line for streamflow hydrograph. Areas with vertical lines on graph indicate no data.

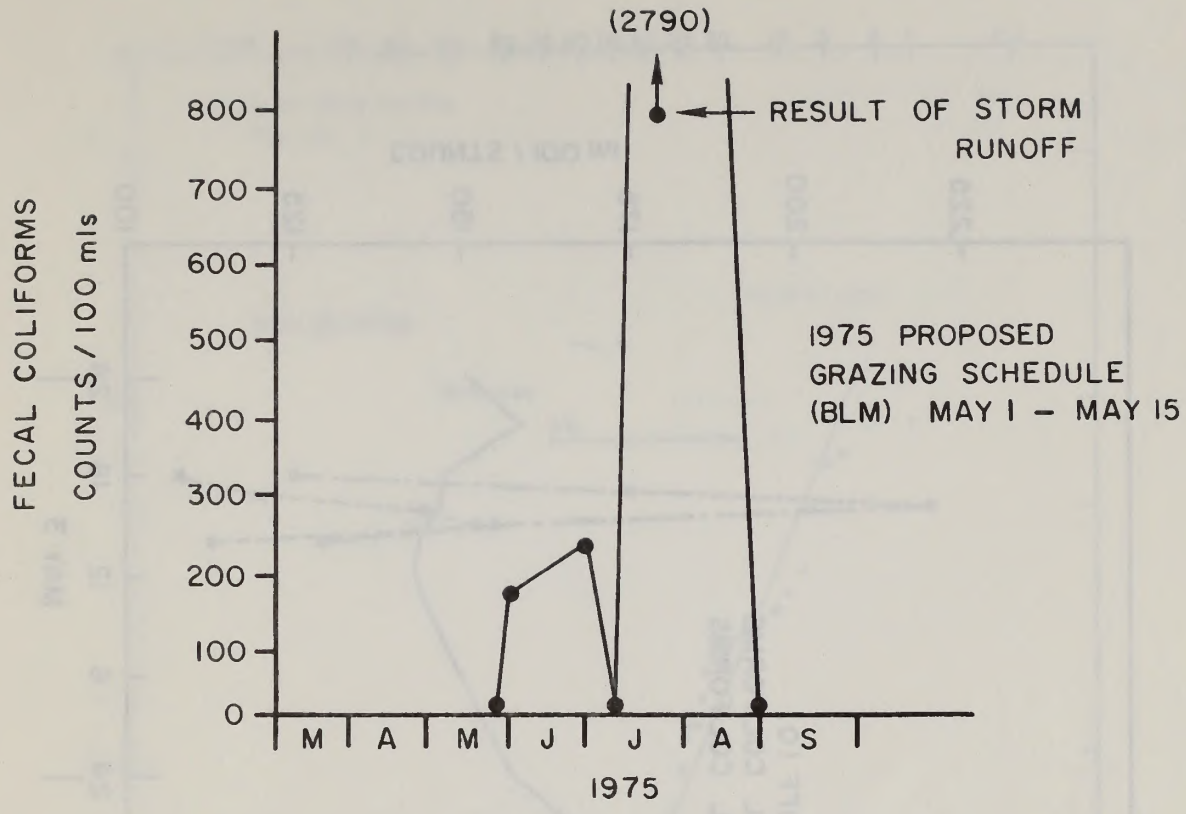


Figure 3. Average fecal coliform concentrations from sample Sites No. 12 and 13 in Soldier Cap grazing allotment.

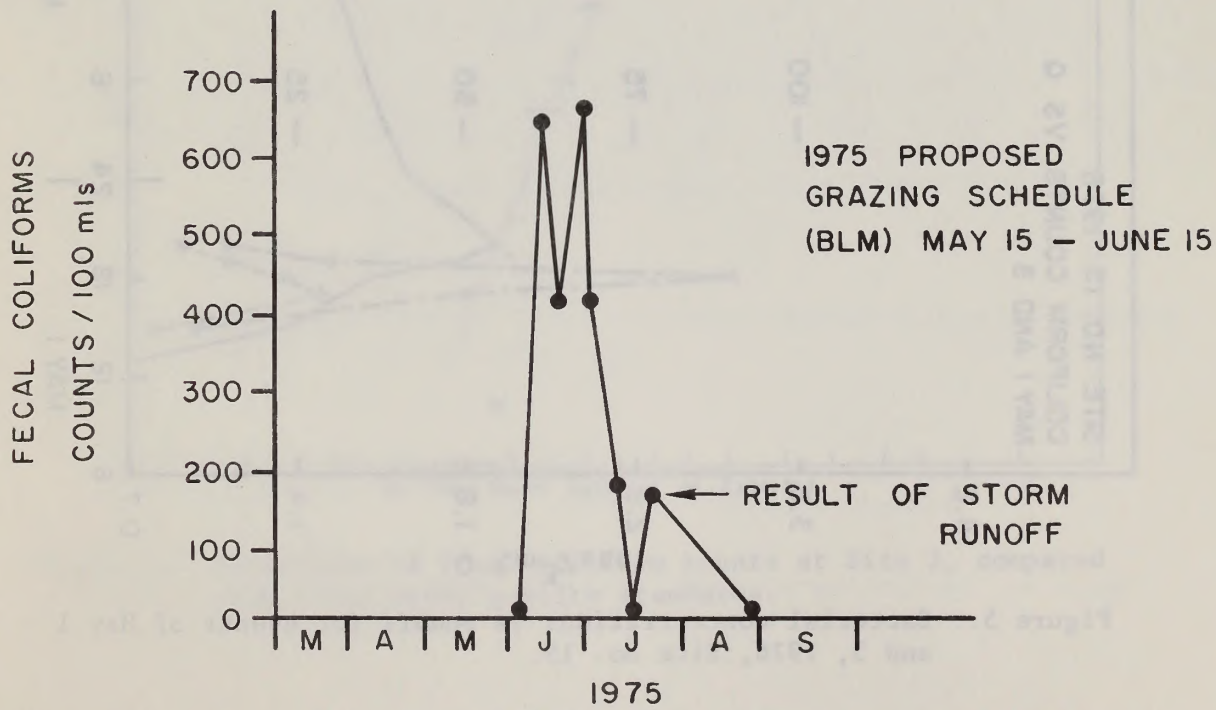


Figure 4. Average fecal coliform concentrations from sample Sites No. 8 and 11 in Salmon Butte grazing allotment.

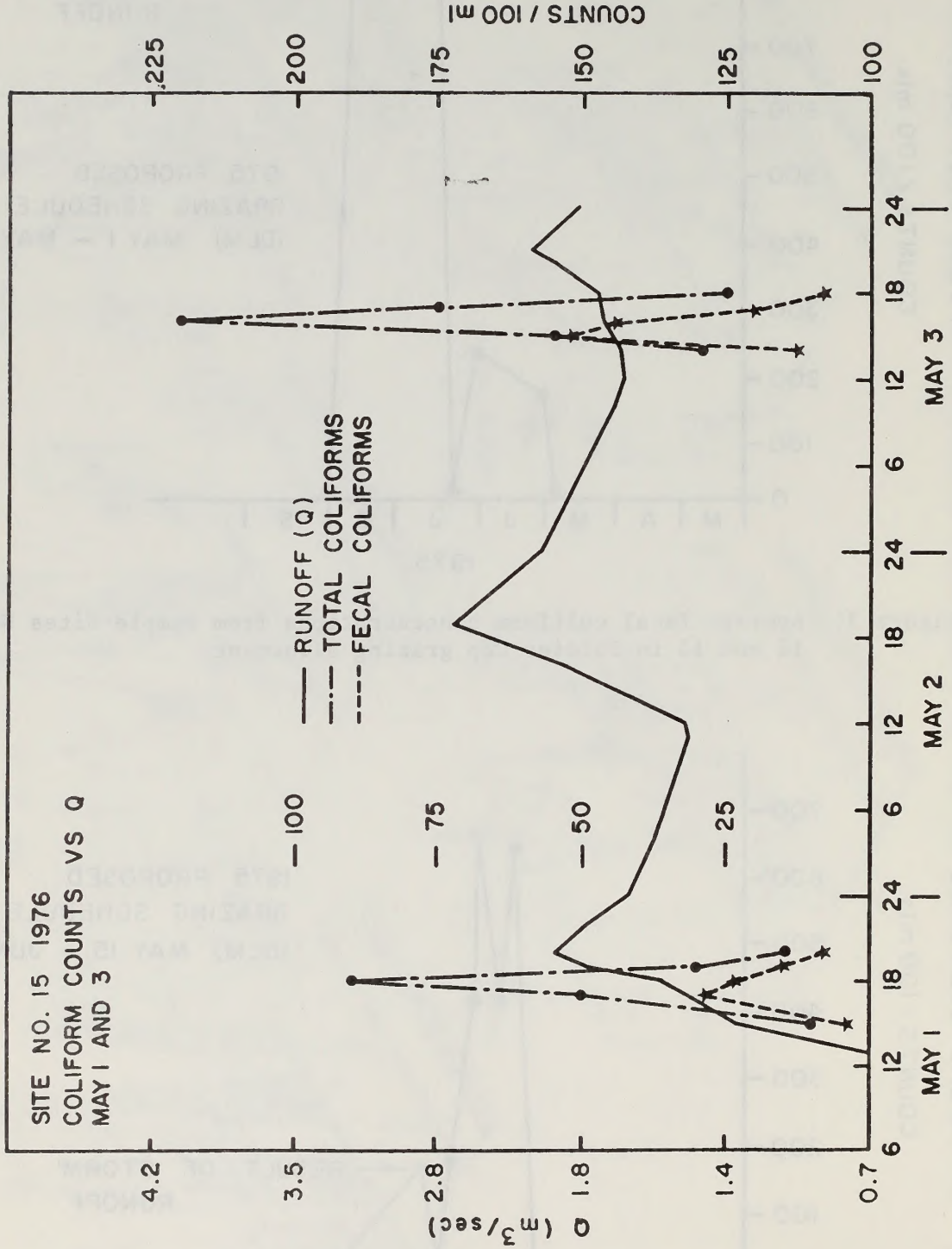


Figure 5. Bacterial concentrations vs runoff for events of May 1 and 3, 1976, Site No. 15.

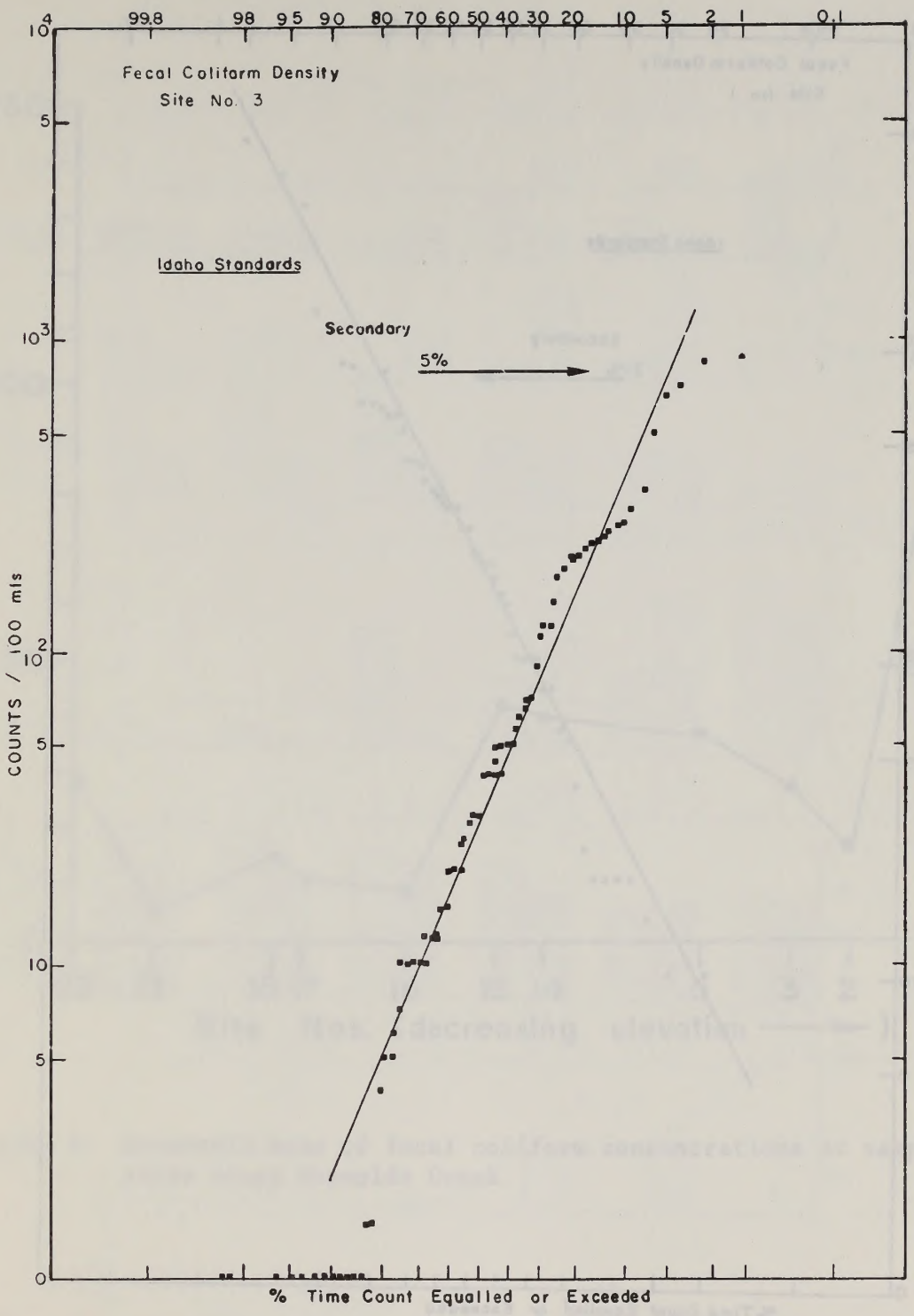


Figure 6. Variations of fecal coliform counts at Site 3, compared with Idaho water quality standards.

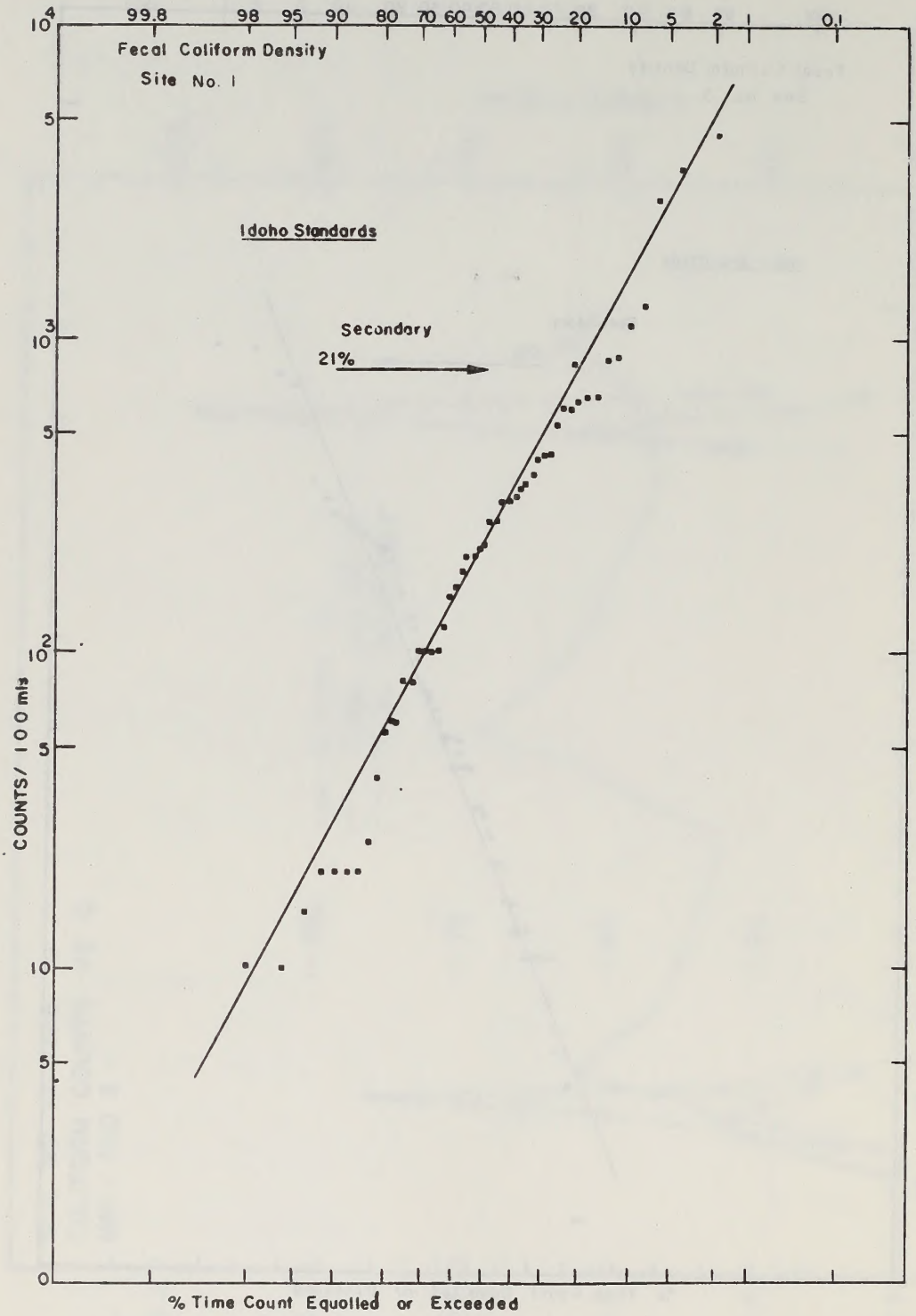


Figure 7. Variations of fecal coliform counts at Site 1, compared with Idaho water quality standards.

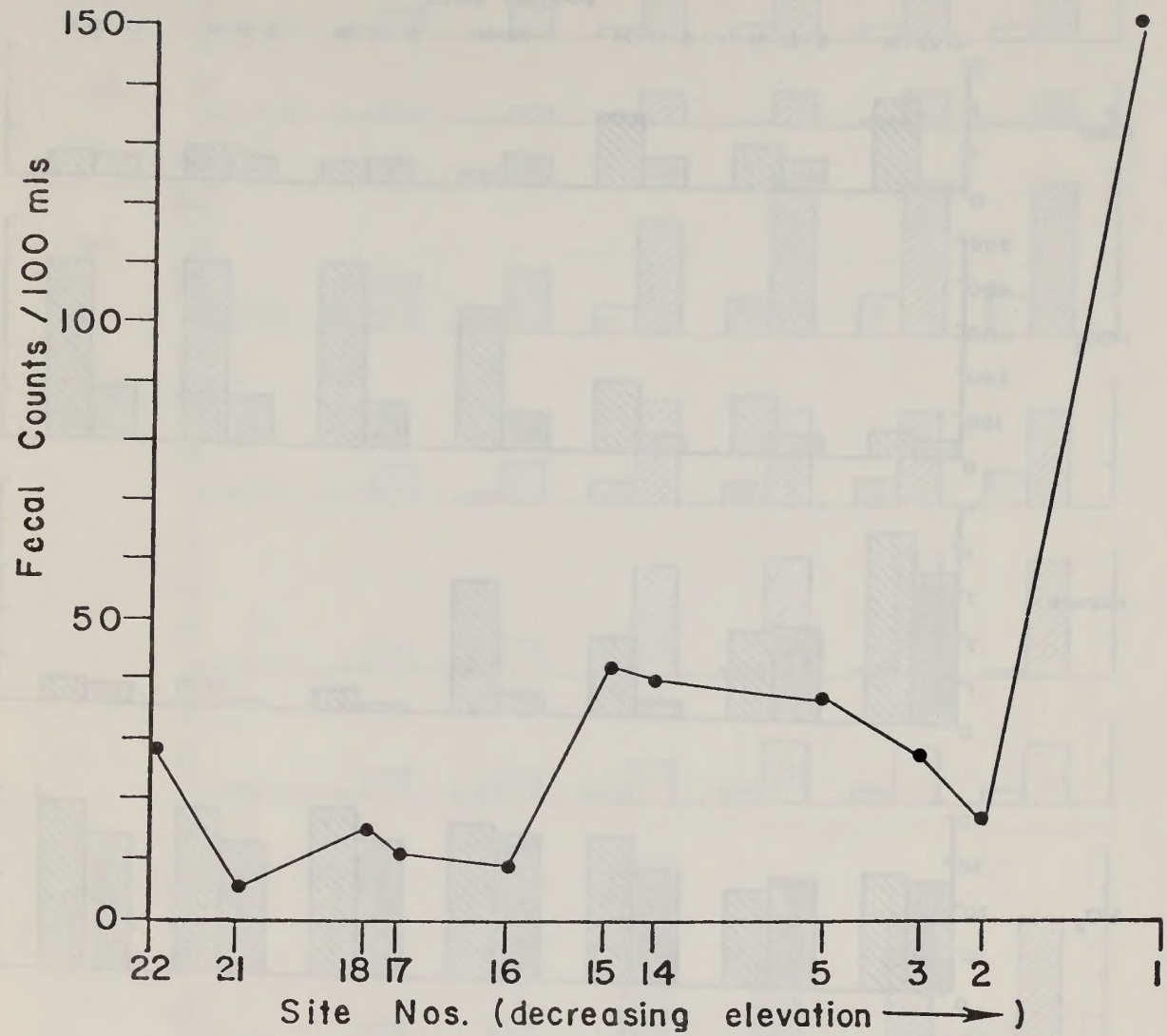


Figure 8. Geometric mean of fecal coliform concentrations at sampling sites along Reynolds Creek.

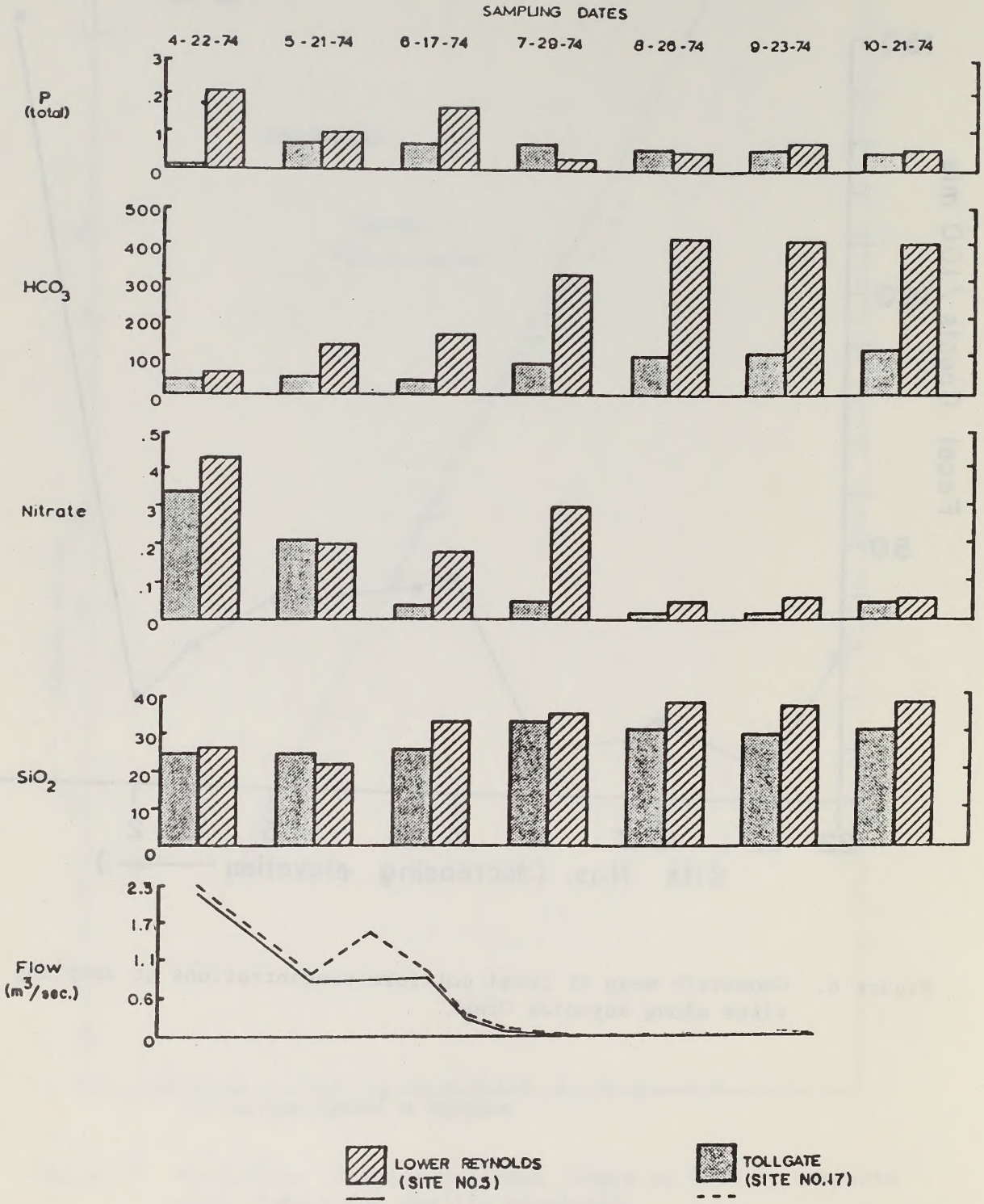


Figure 9. Major chemical constituents (mgl) and streamflow for Sites No. 5 and 17 for 1974 irrigation season.

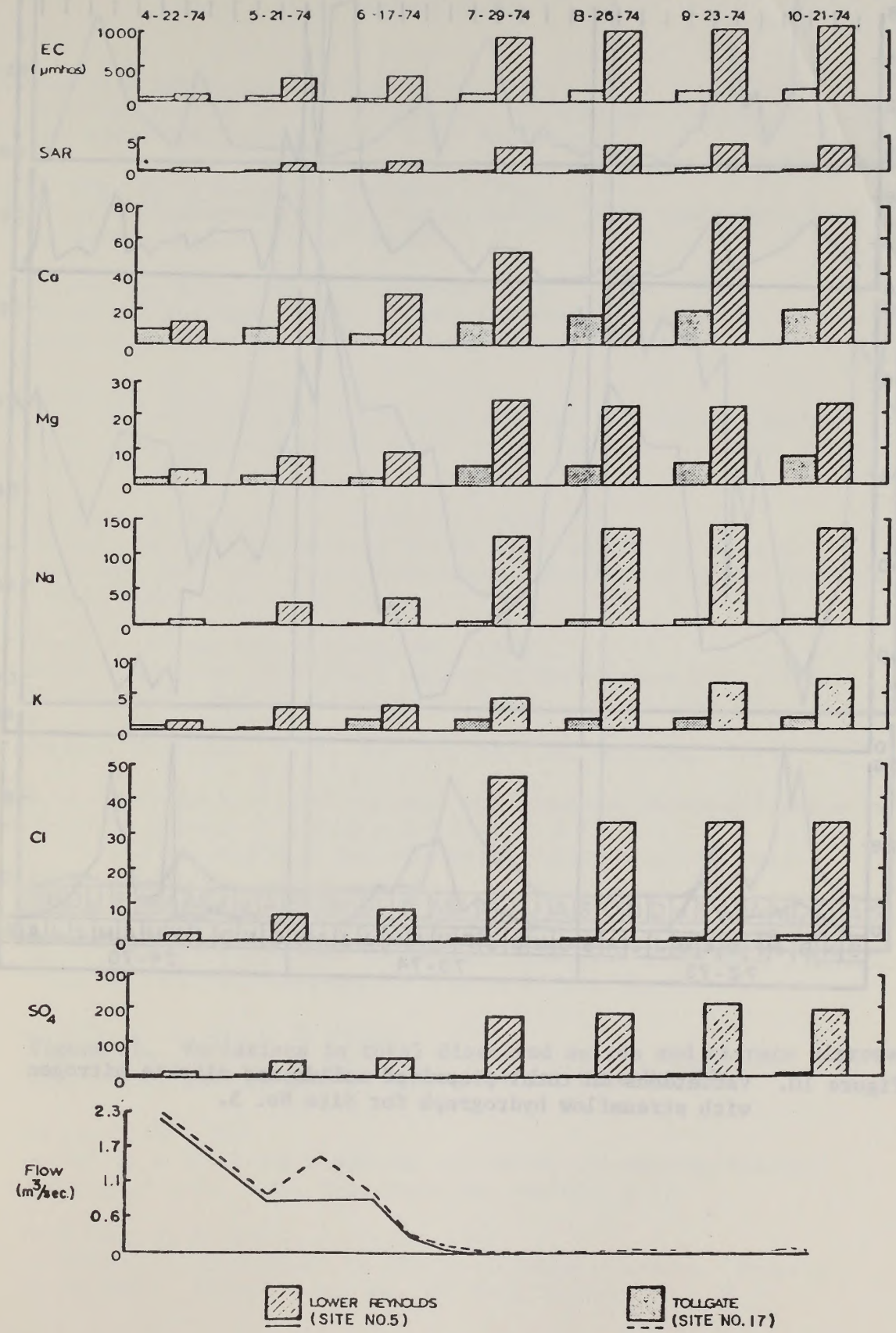


Figure 9. Cont'd

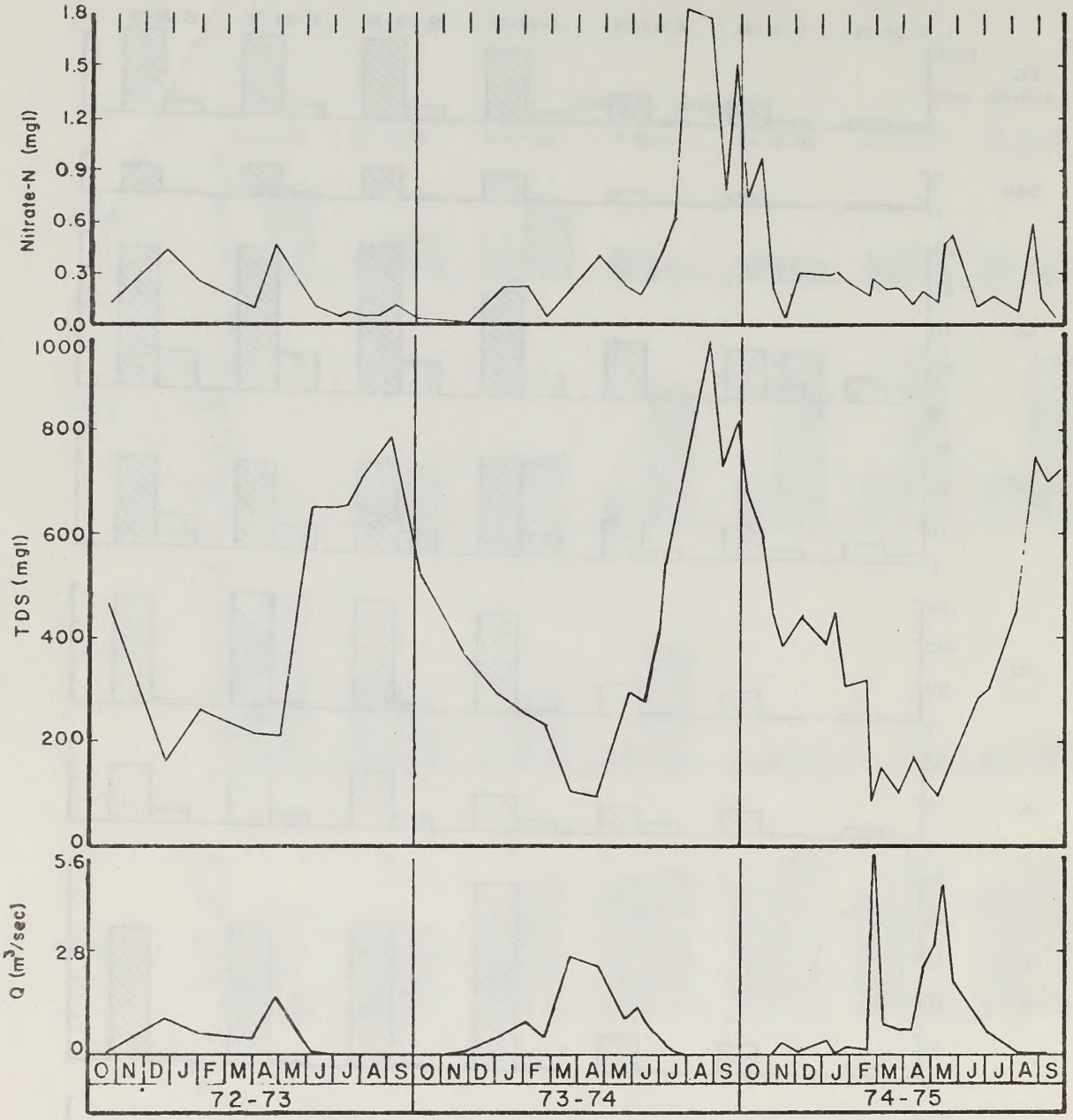


Figure 10. Variations in total dissolved solids and nitrate nitrogen with streamflow hydrograph for Site No. 5.

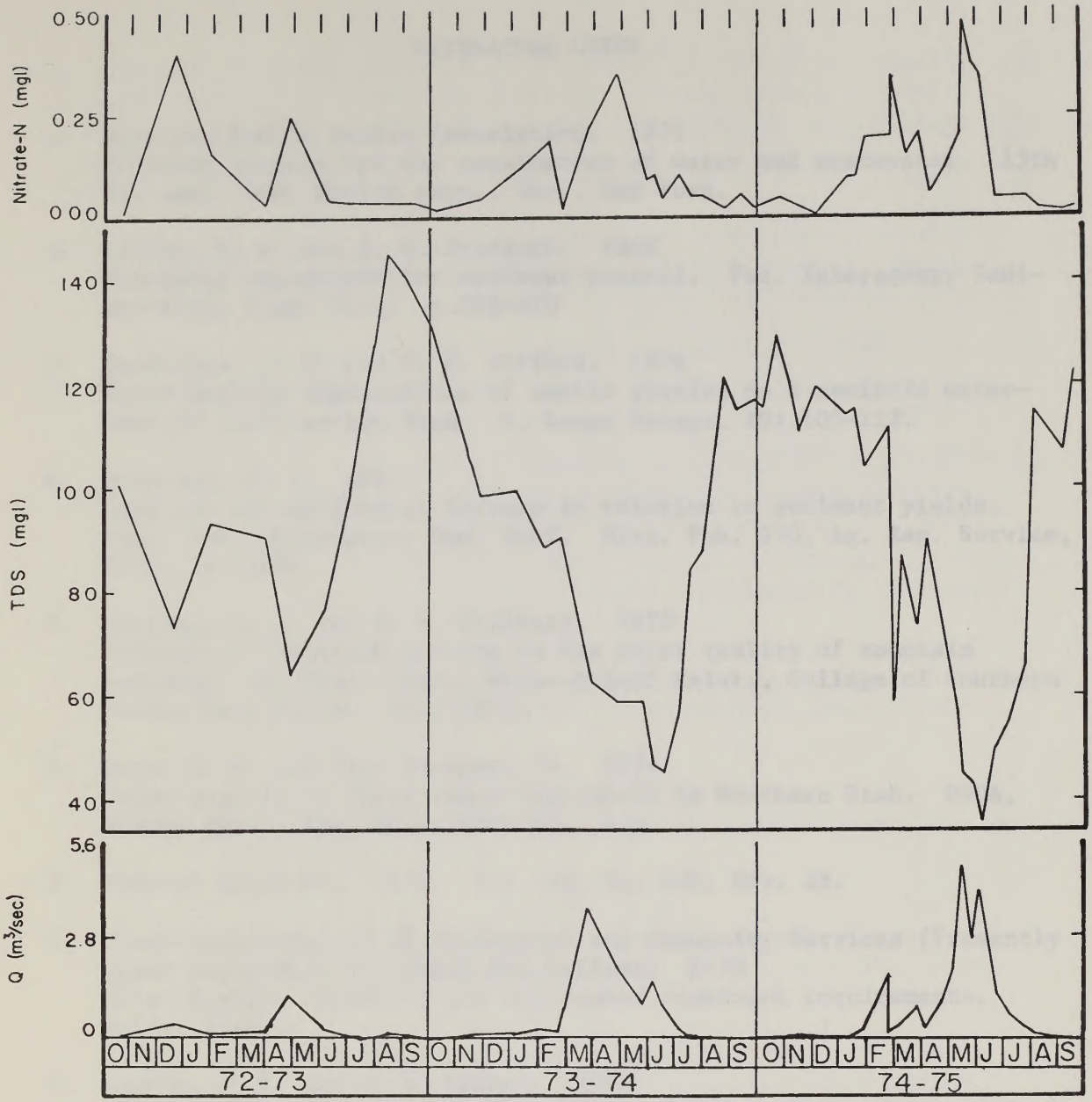


Figure 11. Variations in total dissolved solids and nitrate nitrogen with streamflow hydrograph for Site No. 17.

LITERATURE CITED

1. American Public Health Association. 1971
Standard methods for the examination of water and wastewater. 13th Ed. Amer. Pub. Health Assn., Inc., New York.

2. Bailey, R. W. and G. W. Craddock. 1948
Watershed management for sediment control. Fed. Interagency Sedimentation Cong. Proc. p 302-310

3. Buckhouse, J. C. and G. F. Gifford. 1976
Water quality implications of cattle grazing on a semiarid watershed in southeastern Utah. J. Range Manage. 29: 109-112.

4. Copeland, O. T. 1963
Land use and ecological factors in relation to sediment yields. Proc. Fed. Interagency Sed. Conf. Misc. Pub. 970, Ag. Res. Service, USDA. p 72-84

5. Darling, L. A. and G. B. Coltharp. 1973
Effects of livestock grazing on the water quality of mountain streams. In: Proc. Symp., Water-Animal Relat., College of Southern Idaho, Twin Falls. June 1973.

6. Doty, R. D. and Ezra Hookano, Jr. 1974
Water quality of three small watersheds in Northern Utah. USDA, Forest Serv., Res. Note, INT-186. 6 p.

7. Federal Register. 1975. Vol. 40, No. 230, Nov. 28.

8. Idaho Department of Environmental and Community Services (Presently Idaho Department of Health and Welfare) 1973
Water quality standards and wastewater treatment requirements. Boise, Idaho.

9. Kunkle, S. H. and J. R. Meiman. 1967
Water quality of mountain watersheds. Colorado State Univ., Hydrol. Paper No. 21, Fort Collins, CO. 53 p.

10. Kunkle, S. H. and J. R. Meiman. 1968
Sampling bacteria in a mountain stream. Colorado State Univ., Hydrol. Paper No. 28, Fort Collins, CO. 27 p.

11. Milne, C. M. 1974
Effect of a livestock wintering operation on a western mountain stream. Am. Soc. Agr. Eng. Paper No. 74-4058: 1-17.

12. Morrison, S. M. and J. F. Fair. 1966
Influence of environment on stream microbial dynamics. Colorado State Univ., Hydrol. Paper No. 13, Fort Collins, CO. 21 p.

13. Skinner, Q. D., J. C. Adams, P. A. Rechard, and A. A. Beetle. 1974
Effect of summer use of a mountain watershed on bacterial water quality. J. Environ. Quality 3: 329-335.

14. Stuart, D. G., G. K. Bissonnette, T. D. Goodrich, and W. D. Walter. 1971
Effects of multiple use on water quality of high mountain watersheds: Bacteriological investigations of mountain streams. J. Appl. Microbiology 22: 1048-1054.

15. U. S. Dept. of Interior, Bureau of Land Management. 1975
Reynolds Creek allotment management plan. Boise District, Boise, Idaho.

16. Walter, W. G. and R. P. Bottman. 1967
Microbiological and chemical studies of an open and closed watershed. J. Environ. Health 30: 157-163.

REFERENCE INFORMATION

Additional information on Water Quality and Sediment Yield Investigations at the Northwest Watershed Research Center may be found through the following sources:

1. Johnson, C. W. 1969
   Sediment yield from snowmelt runoff--Southwest Idaho. Presented at Amer. Geophys. Union Natl. Fall Meeting, San Francisco, CA. Trans. Amer. Geophys. Union 59(11): 615 (H47) Abstract.

2. Johnson, C. W. and R. P. McArthur. 1973
   Winter storm and flood analysis, Northwest Interior. Proc. Hydraulic Div. Spec. Conf., Amer. Soc. of Civil Engin., Bozeman, MT.

3. Johnson, C. W., G. R. Stephenson, C. L. Hanson, R. L. Engleman, and C. D. Engelbert. 1974
   Sediment yield from Southwest Idaho rangeland watersheds. Pres. Winter Meeting, Amer. Soc. Agri. Engin., Chicago, IL, December.

4. Stephenson, G. R. and J. F. Zuzel. 1975
   Chemical analyses of a ground-water flow system. Abstract in Proc. Pres. at Annual Meeting of Rocky Mountain Sec., Geol. Soc. Amer., Boise, Idaho.

5. Zuzel, J. F. and G. R. Stephenson. 1975
   Malathion induced mortality in an aquatic insect ecosystem. Unpub. Center publication.

6. Johnson, C. W., and C. L. Hanson. 1976
   Sediment sources and yields from sagebrush rangeland watersheds. Proc. Inter-Agency Sedimentation Conf., p 1-71 to 1-80. Denver, CO, March.

7. Stephenson, G. R. and L. V. Street. 1976
   Quality of runoff from nonpoint sources on a southwest Idaho rangeland watershed. Abstract. Pres. at the 43rd Ann. Meeting of the Northwest Pollution Control Administration, Seattle, WA, October.

8. Stephenson, G. R. and L. V. Street. 1977
   Bacterial variations in streams from a southwest Idaho rangeland watershed. Submitted for publication to J. of Environ. Quality.

APPENDIX

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1972-1973 Data

1972-1973

SITE NO. 3 (Reynolds Outlet)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	21.00	6.00	14.27	11
SiO_2	mg/l	40.00	27.00	33.75	11
Ortho P	mg/l	0.12	0.02	0.06	11
Total P	mg/l	0.26	0.05	0.10	11
Ammonia	mg/l	0.02	0.00	0.01	11
Nitrite	mg/l	0.00	0.00	0.00	11
Nitrate	mg/l	0.47	0.05	0.17	11
Organic-N	mg/l	0.64	0.18	0.39	11
BOD (5)	mg/l	4.00	0.00	2.63	8
DO	mg/l	13.00	9.00	10.89	11
Susp. Sed.	mg/l	44.00	0.00	20.89	9
CO_3	mg/l	12.30	0.00	2.73	11
HCO_3	mg/l	370.96	105.55	250.76	11
Cl	mg/l	55.65	7.80	34.29	11
SO_4	mg/l	273.76	34.58	152.98	11
Ca	mg/l	74.15	21.24	48.33	11
Mg	mg/l	33.67	7.42	19.53	11
Na	mg/l	156.55	20.69	96.28	11
K	mg/l	39.11	2.35	7.85	11
Coli. (T)	cts/100 ml	6000.00	20.00	1067.50	10
Coli. (F)	cts/100 ml	325.00	0.0	77.70	10
pH (Lab)	pH Units	8.82	7.44	8.31	11
E. Cond.	µmhos	1209.00	258.00	782.45	11
Turb.	JTU	39.00	0.00	7.73	11
Flow	CFS	53.29	1.06	13.23	11
Temp.	^oC	27.00	1.50	15.18	11
TDS	mg/l	785.85	167.70	508.59	11
SAR	ratio	4.22	0.98	2.78	11
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 5 (Lower Reynolds)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	22.00	6.00	13.82	11
SiO_2	mg/l	39.00	24.20	32.64	11
Ortho P	mg/l	0.10	0.04	0.07	11
Total P	mg/l	0.18	0.05	0.11	11
Ammonia	mg/l	0.03	0.00	0.01	11
Nitrite	mg/l	0.01	0.00	0.00	11
Nitrate	mg/l	0.82	0.03	0.21	11
Organic-N	mg/l	0.58	0.18	0.40	11
BOD (5)	mg/l	5.00	1.50	2.75	8
DO	mg/l	13.00	8.00	9.85	11
Susp. Sed.	mg/l	112.00	8.00	32.67	9
CO_3	mg/l	0.00	0.00	0.00	11
HCO_3	mg/l	427.70	109.82	284.45	11
Cl	mg/l	44.00	7.44	28.23	11
SO_4	mg/l	271.37	36.98	157.87	11
Ca	mg/l	90.38	22.24	60.01	11
Mg	mg/l	27.23	7.42	18.18	11
Na	mg/l	158.60	22.99	99.69	11
K	mg/l	10.60	1.60	6.51	11
Coli. (T)	cts/100 ml	2800.00	150.00	826.00	10
Coli. (F)	cts/100 ml	585.00	0.00	103.90	10
pH (Lab)	pH Units	8.41	7.52	8.07	11
E. Cond.	µmhos	1248.00	275.00	816.82	11
Turb.	JTU	39.00	1.00	8.27	11
Flow	CFS	29.65	0.95	8.21	11
Temp.	°C	25.00	1.50	14.50	11
TDS	mg/l	811.20	178.75	530.93	11
SAR	ratio	3.94	1.08	2.71	11
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 14 (Tyson)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	18.00	6.00	11.25	8
SiO_2	mg/l	40.20	23.00	30.97	8
Ortho P	mg/l	0.08	0.03	0.06	8
Total P	mg/l	0.15	0.06	0.10	8
Ammonia	mg/l	0.01	0.00	0.00	8
Nitrite	mg/l	0.00	0.00	0.00	8
Nitrate	mg/l	0.40	0.03	0.18	8
Organic-N	mg/l	0.61	0.12	0.36	8
BOD (5)	mg/l	5.00	0.50	2.13	4
DO	mg/l	13.00	7.00	9.25	6
Susp. Sed.	mg/l	42.00	4.00	21.67	6
CO_3	mg/l	0.00	0.00	0.00	8
HCO_3	mg/l	270.90	78.70	165.58	8
Cl	mg/l	13.10	1.80	6.55	8
SO_4	mg/l	96.10	10.60	44.55	8
Ca	mg/l	52.30	14.83	32.23	8
Mg	mg/l	18.70	5.10	11.60	8
Na	mg/l	53.10	7.82	26.46	8
K	mg/l	4.70	1.17	2.84	8
Coli. (T)	cts/100 ml	3600.00	100.00	1408.00	5
Coli. (F)	cts/100 ml	290.00	2.00	106.40	5
pH (Lab)	pH Units	8.07	7.50	7.85	8
E. Cond.	µmhos	635.00	160.00	360.38	8
Turb.	JTU	34.00	2.00	10.50	8
Flow	CFS	23.72	1.67	8.60	8
Temp.	°C	24.00	1.00	11.31	8
TDS	mg/l	412.75	104.00	234.24	8
SAR	ratio	1.60	0.44	0.94	8
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 15 (Nettleton)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	18.00	5.00	9.55	11
SiO_2	mg/l	45.20	22.20	33.60	11
Ortho P	mg/l	0.08	0.03	0.06	11
Total P	mg/l	0.17	0.06	0.10	11
Ammonia	mg/l	0.02	0.00	0.01	11
Nitrite	mg/l	0.01	0.00	0.00	11
Nitrate	mg/l	0.40	0.05	0.24	11
Organic-N	mg/l	0.52	0.12	0.32	11
BOD (5)	mg/l	5.00	1.00	2.34	8
DO	mg/l	12.00	6.00	8.61	9
Susp. Sed.	mg/l	66.00	0.00	26.56	9
CO_3	mg/l	0.00	0.00	0.00	11
HCO_3	mg/l	201.95	68.94	143.10	11
Cl	mg/l	11.34	0.70	4.90	11
SO_4	mg/l	36.98	6.20	17.53	11
Ca	mg/l	39.68	12.82	26.16	11
Mg	mg/l	14.47	4.10	9.33	11
Na	mg/l	26.67	6.44	16.12	11
K	mg/l	4.30	1.56	2.88	11
Coli. (T)	cts/100 ml	1200.00	150.00	608.33	6
Coli. (F)	cts/100 ml	350.00	40.00	165.71	7
pH (Lab)	pH Units	8.11	7.35	7.80	11
E. Cond.	µmhos	428.00	131.00	274.91	11
Turb.	JTU	34.00	1.00	8.55	11
Flow	CFS	22.24	0.08	6.08	11
Temp.	°C	20.00	0.50	12.30	11
TDS	mg/l	278.20	85.15	178.69	11
SAR	ratio	0.94	0.39	0.66	11
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 17 (Tollgate)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	17.00	4.00	7.18	11
SiO_2	mg/l	35.20	22.20	28.31	11
Ortho P	mg/l	0.08	0.02	0.05	11
Total P	mg/l	0.31	0.04	0.10	11
Ammonia	mg/l	0.02	0.00	0.01	11
Nitrite	mg/l	0.00	0.00	0.00	11
Nitrate	mg/l	0.40	0.01	0.04	11
Organic-N	mg/l	0.85	0.10	0.31	11
BOD (5)	mg/l	4.00	1.00	2.14	9
DO	mg/l	11.00	7.00	8.69	11
Susp. Sed.	mg/l	216.00	0.00	35.00	9
CO_3	mg/l	0.00	0.00	0.00	11
HCO_3	mg/l	131.79	55.50	94.23	11
Cl	mg/l	10.60	0.00	1.79	11
SO_4	mg/l	8.17	0.50	3.79	11
Ca	mg/l	22.04	10.60	16.27	11
Mg	mg/l	9.12	3.80	6.54	11
Na	mg/l	10.11	4.80	7.00	11
K	mg/l	1.96	0.78	1.46	11
Coli. (T)	cts/100 ml	3300.00	100.00	988.89	9
Coli. (F)	cts/100 ml	175.00	0.00	56.11	9
pH (Lab)	pH Units	8.15	7.20	7.75	11
E. Cond.	µmhos	223.00	99.00	157.91	11
Turb.	JTU	66.00	1.00	14.60	10
Flow	CFS	43.59	0.19	8.73	11
Temp.	°C	20.00	0.00	11.92	10
TDS	mg/l	144.95	64.35	102.64	11
SAR	ratio	0.47	0.30	0.37	11
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 20 (Dobson)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	25.00	5.00	8.91	11
SiO_2	mg/l	32.40	20.80	27.84	11
Ortho P	mg/l	0.07	0.02	0.04	11
Total P	mg/l	0.23	0.05	0.09	11
Ammonia	mg/l	0.01	0.00	0.00	11
Nitrite	mg/l	0.00	0.00	0.00	11
Nitrate	mg/l	0.29	0.02	0.08	11
Organic-N	mg/l	0.67	0.11	0.27	11
BOD (5)	mg/l	6.00	1.00	3.04	8
DO	mg/l	12.00	7.50	9.22	11
Susp. Sed.	mg/l	84.00	4.00	19.00	9
CO_3	mg/l	0.00	0.00	0.00	11
HCO_3	mg/l	112.87	53.08	84.25	11
Cl	mg/l	1.10	0.00	0.26	11
SO_4	mg/l	6.24	0.00	1.91	11
Ca	mg/l	20.64	1.20	14.35	11
Mg	mg/l	7.17	2.90	5.10	11
Na	mg/l	7.36	4.10	5.75	11
K	mg/l	1.60	0.78	1.18	11
Coli. (T)	cts/100 ml	3300.00	190.00	835.50	10
Coli. (F)	cts/100 ml	400.00	0.00	85.60	10
pH (Lab)	pH Units	8.10	7.17	7.73	11
E. Cond.	µmhos	192.00	97.00	139.73	11
Turb.	JTU	60.00	1.00	10.64	11
Flow	CFS	37.29	0.01	4.77	11
Temp.	°C	17.50	0.00	10.04	10
TDS	mg/l	124.80	63.05	90.82	11
SAR	ratio	0.52	0.28	0.34	11
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 21 (Democrat)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	23.00	3.00	7.30	10
SiO_2	mg/l	21.20	16.20	19.24	10
Ortho P	mg/l	0.10	0.02	0.04	10
Total P	mg/l	0.20	0.03	0.08	10
Ammonia	mg/l	0.01	0.00	0.00	10
Nitrite	mg/l	0.01	0.00	0.00	10
Nitrate	mg/l	0.73	0.04	0.28	10
Organic-N	mg/l	0.67	0.13	0.25	10
BOD (5)	mg/l	6.00	1.00	2.67	9
DO	mg/l	11.00	8.00	9.30	10
Susp. Sed.	mg/l	40.00	6.00	17.50	8
CO_3	mg/l	0.00	0.00	0.00	10
HCO_3	mg/l	64.67	26.24	46.18	10
Cl	mg/l	0.70	0.00	0.17	10
SO_4	mg/l	10.09	2.40	6.25	10
Ca	mg/l	14.83	6.01	10.55	10
Mg	mg/l	3.28	0.60	2.20	10
Na	mg/l	5.52	3.22	4.76	10
K	mg/l	1.60	0.40	0.99	10
Coli. (T)	cts/100 ml	1050.00	0.00	375.00	9
Coli. (F)	cts/100 ml	75.00	0.00	2.52	8
pH (Lab)	pH Units	8.48	6.92	7.58	10
E. Cond.	µmhos	126.00	62.00	93.80	10
Turb.	JTU	36.00	1.00	11.60	10
Flow	CFS	3.26	0.01	0.44	11
Temp.	°C	16.00	0.50	9.50	9
TDS	mg/l	81.90	40.30	60.97	10
SAR	ratio	0.39	0.30	0.35	10
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 22 (Reynolds Mtn. Weir)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	24.00	4.00	9.38	8
SiO_2	mg/l	27.20	10.40	19.57	9
Ortho P	mg/l	0.03	0.01	0.02	9
Total P	mg/l	0.20	0.03	0.06	9
Ammonia	mg/l	0.01	0.00	0.00	9
Nitrite	mg/l	0.00	0.00	0.00	9
Nitrate	mg/l	0.34	0.02	0.12	9
Organic-N	mg/l	1.18	0.12	0.29	9
BOD (5)	mg/l	6.00	1.00	2.83	6
DO	mg/l	11.00	6.00	8.38	8
Susp. Sed.	mg/l	123.00	2.00	23.00	7
CO_3	mg/l	0.00	0.00	0.00	9
HCO_3	mg/l	55.52	21.35	30.96	9
Cl	mg/l	0.71	0.00	0.20	9
SO_4	mg/l	4.32	0.00	1.39	9
Ca	mg/l	8.22	4.00	5.29	9
Mg	mg/l	2.80	0.70	1.48	9
Na	mg/l	5.75	2.80	3.78	9
K	mg/l	2.70	0.39	1.00	9
Coli. (T)	cts/100 ml	5100.00	200.00	1225.71	7
Coli. (F)	cts/100 ml	560.00	0.00	181.43	7
pH (Lab)	pH Units	7.50	6.45	7.06	9
E. Cond.	µmhos	96.00	45.00	59.44	9
Turb.	JTU	12.00	3.00	7.00	9
Flow	CFS	1.10	0.01	0.16	9
Temp.	°C	17.00	1.00	8.30	9
TDS	mg/l	62.40	29.25	38.64	9
SAR	ratio	0.46	0.30	0.37	9
Fec. Strep.	cts/100 ml	--	--	--	0

1972-1973

SITE NO. 23 (Reynolds Mtn. Spring)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	1.00	0.00	0.20	11
SiO_2	mg/l	11.80	8.80	10.26	11
Ortho P	mg/l	0.02	0.00	0.01	11
Total P	mg/l	0.06	0.01	0.02	11
Ammonia	mg/l	0.01	0.00	0.00	11
Nitrite	mg/l	0.01	0.00	0.00	11
Nitrate	mg/l	3.05	1.64	2.31	11
Organic-N	mg/l	0.18	0.00	0.07	11
BOD (5)	mg/l	3.00	0.50	1.69	8
DO	mg/l	9.00	7.00	8.44	9
Susp. Sed.	mg/l	8.00	0.00	4.11	9
CO_3	mg/l	0.00	0.00	0.00	11
HCO_3	mg/l	11.00	6.70	8.37	11
Cl	mg/l	1.80	0.00	0.93	11
SO_4	mg/l	1.44	0.35	0.78	11
Ca	mg/l	5.21	3.41	4.39	11
Mg	mg/l	0.73	0.10	0.52	11
Na	mg/l	2.50	1.60	1.95	11
K	mg/l	1.20	0.39	0.68	11
Coli. (T)	cts/100 ml	112.00	0.00	21.13	8
Coli. (F)	cts/100 ml	3.00	0.00	0.63	8
pH (Lab)	pH Units	7.52	6.01	6.37	11
E. Cond.	µmhos	49.00	34.00	43.82	11
Turb.	JTU	3.00	0.00	1.27	11
Flow	CFS	0.03	0.01	0.01	11
Temp.	°C	7.00	3.00	5.02	10
TDS	mg/l	31.85	22.10	28.48	11
SAR	ratio	0.31	0.18	0.23	11
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974 Data

1973-1974

SITE NO. 1 (Reynolds at Snake)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	24.00	12.00	17.64	14
SiO_2	mg/l	45.70	28.80	37.85	15
Ortho P	mg/l	0.26	0.03	0.10	15
Total P	mg/l	0.54	0.07	0.19	15
Ammonia	mg/l	0.05	0.00	0.01	14
Nitrite	mg/l	0.05	0.00	0.01	15
Nitrate	mg/l	2.38	0.06	1.07	15
Organic-N	mg/l	0.80	0.05	0.42	14
BOD (5)	mg/l	--	--	--	0
DO	mg/l	13.00	5.00	7.40	10
Susp. Sed.	mg/l	150.00	2.00	33.33	15
CO_3	mg/l	0.90	0.00	0.06	15
HCO_3	mg/l	429.53	89.08	285.25	15
Cl	mg/l	37.22	3.19	26.00	15
SO_4	mg/l	312.20	19.21	190.52	15
Ca	mg/l	141.48	17.23	79.27	15
Mg	mg/l	35.62	5.84	22.30	15
Na	mg/l	124.60	14.25	80.06	15
K	mg/l	10.95	2.35	6.07	15
Coli. (T)	cts/100 ml	8160.00	300.00	1980.55	18
Coli. (F)	cts/100 ml	2720.00	10.00	345.27	18
pH (Lab)	pH Units	8.40	7.54	7.97	15
E. Cond.	µmhos	1282.00	189.00	816.00	15
Turb.	JTU	38.00	1.00	8.43	14
Flow	CFS	--	--	--	0
Temp.	°C	29.00	0.00	14.42	12
TDS	mg/l	833.30	122.85	530.40	15
SAR	ratio	2.57	0.76	0.29	15
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 2 (Rattlesnake)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	30.00	7.00	18.53	15
SiO_2	mg/l	34.50	17.40	27.93	15
Ortho P	mg/l	0.10	0.00	0.05	15
Total P	mg/l	0.43	0.01	0.12	15
Ammonia	mg/l	0.08	0.00	0.01	14
Nitrite	mg/l	0.00	0.00	0.00	15
Nitrate	mg/l	0.31	0.01	0.12	15
Organic-N	mg/l	0.84	0.13	0.45	14
BOD (5)	mg/l	--	--	--	0
DO	mg/l	12.00	7.00	8.30	10
Susp. Sed.	mg/l	100.00	4.00	28.40	15
CO_3	mg/l	31.20	0.00	5.08	15
HCO_3	mg/l	285.54	73.83	175.35	15
Cl	mg/l	60.26	2.84	27.01	15
SO_4	mg/l	292.99	12.49	125.07	15
Ca	mg/l	51.50	14.03	34.28	15
Mg	mg/l	29.42	4.86	16.14	15
Na	mg/l	147.13	11.26	72.63	15
K	mg/l	8.60	1.17	4.38	15
Coli. (T)	cts/100 ml	1970.00	60.00	726.27	17
Coli. (F)	cts/100 ml	200.00	0.00	34.07	16
pH (Lab)	pH Units	9.12	7.50	8.33	15
E. Cond.	µmhos	1066.00	146.00	586.20	15
Turb.	JTU	31.00	1.00	8.71	14
Flow	CFS	--	--	--	0
Temp.	°C	23.00	0.00	11.63	12
TDS	mg/l	692.90	94.90	381.03	15
SAR	ratio	4.56	0.66	2.40	15
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 3 (Reynolds Outlet Weir)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	29.00	6.00	17.00	16
SiO_2	mg/l	40.00	28.40	34.12	16
Ortho P	mg/l	0.10	0.01	0.07	16
Total P	mg/l	0.24	0.04	0.12	16
Ammonia	mg/l	0.05	0.00	0.00	15
Nitrite	mg/l	0.02	0.00	0.01	16
Nitrate	mg/l	1.82	0.02	0.55	16
Organic-N	mg/l	0.66	0.19	0.36	15
BOD (5)	mg/l	--	--	--	0
DO	mg/l	16.00	4.00	8.58	12
Susp. Sed.	mg/l	62.00	0.00	25.38	16
CO_3	mg/l	27.30	0.00	1.95	16
HCO_3	mg/l	392.31	74.44	230.36	16
Cl	mg/l	60.97	2.48	27.69	16
SO_4	mg/l	297.79	12.49	129.32	16
Ca	mg/l	83.97	14.83	46.74	16
Mg	mg/l	33.43	4.74	17.54	16
Na	mg/l	157.24	10.80	76.67	16
K	mg/l	7.04	1.56	4.18	16
Coli. (T)	cts/100 ml	3000.00	140.00	874.65	29
Coli. (F)	cts/100 ml	495.00	1.00	84.45	29
pH (Lab)	pH Units	8.46	6.90	7.93	16
E. Cond.	µmhos	1490.00	152.00	664.00	16
Turb.	JTU	21.00	1.00	6.67	15
Flow	CFS	97.73	0.81	24.41	16
Temp.	°C	22.00	0.00	10.89	14
TDS	mg/l	968.50	98.80	431.60	16
SAR	ratio	3.95	0.63	2.24	16
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 4 (Salmon Creek)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	2850.00	100.00	922.30	22
Fecal Coli.	cts/100 ml	465.00	0.00	74.10	22
Fecal Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 5 (Lower Reynolds)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	28.00	7.00	15.19	16
SiO_2	mg/l	39.00	26.20	32.61	16
Ortho P	mg/l	0.10	0.00	0.05	16
Total P	mg/l	0.27	0.03	0.10	16
Ammonia	mg/l	0.08	0.00	0.01	15
Nitrite	mg/l	0.00	0.00	0.00	16
Nitrate	mg/l	0.43	0.01	0.15	16
Organic-N	mg/l	0.63	0.16	0.32	15
BOD (5)	mg/l	--	--	--	0
DO	mg/l	12.00	4.00	7.67	12
Susp. Sed.	mg/l	104.00	2.00	28.13	16
CO_3	mg/l	10.20	0.00	0.64	16
HCO_3	mg/l	420.38	65.89	243.25	16
Cl	mg/l	46.44	2.13	19.67	16
SO_4	mg/l	265.61	11.53	109.63	16
Ca	mg/l	74.75	12.83	41.60	16
Mg	mg/l	53.25	4.74	16.56	16
Na	mg/l	162.07	9.43	73.09	16
K	mg/l	9.39	1.17	4.60	16
Coli. (T)	cts/100 ml	6960.00	30.00	1077.90	28
Coli. (F)	cts/100 ml	1500.00	0.00	387.68	28
pH (Lab)	pH Units	8.58	7.52	8.02	16
E. Cond.	µmhos	1183.00	138.00	604.25	16
Turb.	JTU	21.00	1.00	5.73	15
Flow	CFS	76.19	0.66	20.16	16
Temp.	°C	18.00	0.00	10.04	13
TDS	mg/l	768.95	89.70	392.76	16
SAR	ratio	4.07	0.57	2.22	16
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 6 (Macks Creek Weir)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	5560.00	30.00	628.03	20
Fecal Coli.	cts/100 ml	944.00	1.00	66.28	20
Fecal Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 14 (Tysons)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	--	--	7.00	1
SiO_2	mg/l	--	--	30.00	1
Ortho P	mg/l	--	--	0.04	1
Total P	mg/l	--	--	0.05	1
Ammonia	mg/l	--	--	0.00	1
Nitrite	mg/l	--	--	0.00	1
Nitrate	mg/l	--	--	0.04	1
Organic-N	mg/l	--	--	0.19	1
BOD (5)	mg/l	--	--	--	0
DO	mg/l	--	--	12.00	1
Susp. Sed.	mg/l	--	--	12.00	1
CO_3	mg/l	--	--	0.00	1
HCO_3	mg/l	--	--	133.01	1
Cl	mg/l	--	--	3.54	1
SO_4	mg/l	--	--	17.29	1
Ca	mg/l	--	--	24.25	1
Mg	mg/l	--	--	9.36	1
Na	mg/l	--	--	15.86	1
K	mg/l	--	--	1.56	1
Coli. (T)	cts/100 ml	1740.00	260.00	627.00	16
Coli. (F)	cts/100 ml	455.00	0.00	112.00	16
pH (Lab)	pH Units	--	--	8.10	1
E. Cond.	µmhos	--	--	257.00	1
Turb.	JTU	--	--	3.00	1
Flow	CFS	--	--	2.61	1
Temp.	°C	--	--	4.00	1
TDS	mg/l	--	--	167.05	1
SAR	ratio	--	--	0.69	1
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 15 (Nettleton)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	7.00	7.00	7.00	2
SiO_2	mg/l	35.30	29.80	32.55	2
Ortho P	mg/l	0.06	0.03	0.04	2
Total P	mg/l	0.08	0.04	0.06	2
Ammonia	mg/l	0.06	0.00	0.03	2
Nitrite	mg/l	0.00	0.00	0.00	2
Nitrate	mg/l	0.10	0.04	0.07	2
Organic-N	mg/l	0.18	0.18	0.18	2
BOD (5)	mg/l	--	--	--	0
DO	mg/l	13.00	10.00	11.50	2
Susp. Sed.	mg/l	28.00	0.00	14.00	2
CO_3	mg/l	0.00	0.00	0.00	2
HCO_3	mg/l	198.29	115.92	157.11	2
Cl	mg/l	9.57	2.48	6.03	2
SO_4	mg/l	30.26	11.53	20.89	2
Ca	mg/l	36.67	21.04	28.86	2
Mg	mg/l	13.37	8.02	10.70	2
Na	mg/l	25.52	11.26	18.39	2
K	mg/l	4.30	1.56	2.93	2
Coli. (T)	cts/100 ml	6400.00	90.00	1586.00	23
Coli. (F)	cts/100 ml	360.00	1.00	103.00	23
pH (Lab)	pH Units	8.20	7.58	7.89	2
E. Cond.	µmhos	381.00	214.00	297.50	2
Turb.	JTU	3.00	0.00	1.50	2
Flow	CFS	2.63	0.72	1.67	2
Temp.	°C	9.50	3.50	6.50	2
TDS	mg/l	247.65	139.10	193.37	2
SAR	ratio	0.92	0.53	0.72	2
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 16 (Gabica)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	1800.00	20.00	494.68	22
Fecal Coli.	cts/100 ml	168.00	0.00	35.38	22
Fecal Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 17 (Tollgate)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	10.00	1.00	5.81	16
SiO_2	mg/l	33.00	23.00	27.54	16
Ortho P	mg/l	0.06	0.02	0.04	16
Total P	mg/l	0.15	0.04	0.08	16
Ammonia	mg/l	0.06	0.00	0.01	14
Nitrite	mg/l	0.01	0.00	0.00	16
Nitrate	mg/l	0.34	0.02	0.10	16
Organic-N	mg/l	0.46	0.12	0.23	14
BOD (5)	mg/l	--	--	--	0
DO	mg/l	13.00	7.00	8.58	12
Susp. Sed.	mg/l	32.00	0.00	11.06	16
CO_3	mg/l	0.00	0.00	0.00	16
HCO_3	mg/l	126.91	40.27	77.94	16
Cl	mg/l	4.25	0.00	0.75	16
SO_4	mg/l	5.28	0.48	2.31	16
Ca	mg/l	21.84	7.21	13.65	16
Mg	mg/l	8.87	2.19	4.83	16
Na	mg/l	9.20	3.45	6.18	16
K	mg/l	2.35	0.39	1.30	16
Coli. (T)	cts/100 ml	3400.00	45.00	710.90	29
Coli. (F)	cts/100 ml	500.00	0.00	59.62	29
pH (Lab)	pH Units	8.34	7.48	7.90	16
E. Cond.	µmhos	201.00	70.00	131.94	16
Turb.	JTU	17.00	1.00	6.07	14
Flow	CFS	128.53	0.55	22.90	16
Temp.	°C	19.50	0.00	9.32	13
TDS	mg/l	130.65	45.50	85.76	16
SAR	ratio	0.46	0.29	0.37	16
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 18 (Below Dobson)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	2320.00	36.00	704.36	23
Fecal Coli.	cts/100 ml	155.00	0.00	41.66	23
Fecal Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 19 (Above Dobson)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	3950.00	24.00	929.56	23
Fecal Coli.	cts/100 ml	388.00	0.00	48.19	23
Fecal Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 20 (Dobson)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	12.00	2.00	6.13	16
SiO_2	mg/l	33.80	24.60	28.21	16
Ortho P	mg/l	0.07	0.02	0.04	16
Total P	mg/l	0.17	0.03	0.07	16
Ammonia	mg/l	0.01	0.00	0.00	14
Nitrite	mg/l	0.01	0.00	0.00	16
Nitrate	mg/l	0.22	0.02	0.10	16
Organic-N	mg/l	0.29	0.12	0.19	14
BOD (5)	mg/l	--	--	--	0
DO	mg/l	13.00	7.00	8.13	12
Susp. Sed.	mg/l	28.00	0.00	13.31	16
CO_3	mg/l	0.00	0.00	0.00	16
HCO_3	mg/l	111.04	41.49	73.67	16
Cl	mg/l	1.77	0.00	0.35	16
SO_4	mg/l	3.36	0.00	1.41	16
Ca	mg/l	20.24	7.41	13.15	16
Mg	mg/l	7.05	2.31	4.32	16
Na	mg/l	7.82	3.45	5.42	16
K	mg/l	1.96	0.39	1.12	16
Coli. (T)	cts/100 ml	3280.00	12.00	715.03	29
Coli. (F)	cts/100 ml	1080.00	0.00	90.93	29
pH (Lab)	pH Units	8.10	7.44	7.84	16
E. Cond.	µmhos	179.00	71.00	121.13	16
Turb.	JTU	17.00	1.00	5.29	14
Flow	CFS	20.78	0.33	5.14	16
Temp.	°C	15.00	0.00	7.69	13
TDS	mg/l	116.35	46.15	78.73	16
SAR	ratio	0.39	0.28	0.33	16
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 21 (Democrat)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	13.00	0.00	6.36	11
SiO_2	mg/l	23.50	15.20	19.20	11
Ortho P	mg/l	0.04	0.02	0.03	11
Total P	mg/l	0.13	0.04	0.06	11
Ammonia	mg/l	0.01	0.00	0.00	9
Nitrite	mg/l	0.01	0.00	0.00	11
Nitrate	mg/l	0.71	0.05	0.21	11
Organic-N	mg/l	0.51	0.12	0.25	9
BOD (5)	mg/l	--	--	--	0
DO	mg/l	10.00	7.00	8.63	8
Susp. Sed.	mg/l	34.00	2.00	14.00	11
CO_3	mg/l	0.00	0.00	0.00	11
HCO_3	mg/l	59.79	23.18	38.16	11
Cl	mg/l	0.35	0.00	0.03	11
SO_4	mg/l	9.13	0.48	4.19	11
Ca	mg/l	13.63	4.01	8.11	11
Mg	mg/l	3.16	0.73	1.67	11
Na	mg/l	5.52	2.99	4.22	11
K	mg/l	1.56	0.78	0.96	11
Coli. (T)	cts/100 ml	2180.00	32.00	721.00	25
Coli. (F)	cts/100 ml	1160.00	0.00	67.68	25
pH (Lab)	pH Units	8.10	7.44	7.75	11
E. Cond.	µmhos	119.00	41.00	73.73	11
Turb.	JTU	23.00	2.00	8.80	10
Flow	CFS	18.20	0.03	3.35	11
Temp.	^oC	16.00	1.50	8.50	9
TDS	mg/l	77.35	26.65	47.92	11
SAR	ratio	0.41	0.32	0.36	11
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 22 (Reynolds Mtn. Weir)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	8.00	3.00	5.00	5
SiO_2	mg/l	26.80	15.00	21.28	5
Ortho P	mg/l	0.03	0.01	0.02	5
Total P	mg/l	0.05	0.03	0.04	5
Ammonia	mg/l	0.01	0.00	0.00	5
Nitrite	mg/l	0.00	0.00	0.00	5
Nitrate	mg/l	0.10	0.04	0.06	5
Organic-N	mg/l	0.23	0.13	0.17	5
BOD (5)	mg/l	--	--	--	0
DO	mg/l	9.00	6.00	8.00	3
Susp. Sed.	mg/l	20.00	0.00	9.60	5
CO_3	mg/l	0.00	0.00	0.00	5
HCO_3	mg/l	34.17	15.86	22.45	5
Cl	mg/l	0.71	0.00	0.28	5
SO_4	mg/l	3.84	0.48	1.73	5
Ca	mg/l	5.21	3.21	4.01	5
Mg	mg/l	1.46	0.24	0.85	5
Na	mg/l	4.37	2.07	3.26	5
K	mg/l	1.17	0.39	0.70	5
Coli. (T)	cts/100 ml	1260.00	32.00	536.90	10
Coli. (F)	cts/100 ml	200.00	6.00	78.80	10
pH (Lab)	pH Units	7.82	7.38	7.54	5
E. Cond.	µmhos	52.00	28.00	41.60	5
Turb.	JTU	14.00	3.00	8.00	4
Flow	CFS	0.17	0.02	0.07	5
Temp.	°C	19.00	1.00	10.00	2
TDS	mg/l	33.80	18.20	27.04	5
SAR	ratio	0.44	0.30	0.38	5
Fec. Strep.	cts/100 ml	--	--	--	0

1973-1974

SITE NO. 23 (Reynolds Mtn. Spring)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	5.00	0.00	1.55	9
SiO_2	mg/l	12.10	5.80	9.91	8
Ortho P	mg/l	0.01	0.01	0.01	9
Total P	mg/l	0.03	0.01	0.02	9
Ammonia	mg/l	0.01	0.00	0.00	8
Nitrite	mg/l	0.00	0.00	0.00	8
Nitrate	mg/l	3.25	0.84	1.97	9
Organic-N	mg/l	0.15	0.05	0.09	8
BOD (5)	mg/l	--	--	--	0
DO	mg/l	9.00	6.00	7.83	6
Susp. Sed.	mg/l	16.00	0.00	4.56	9
CO_3	mg/l	0.00	0.00	0.00	9
HCO_3	mg/l	8.54	6.71	7.93	9
Cl	mg/l	1.06	0.00	0.51	9
SO_4	mg/l	0.96	0.48	0.75	9
Ca	mg/l	5.01	2.81	3.76	9
Mg	mg/l	0.61	0.12	0.39	9
Na	mg/l	2.30	1.15	1.76	9
K	mg/l	0.78	0.39	0.61	9
Coli. (T)	cts/100 ml	10.00	0.00	1.44	18
Coli. (F)	cts/100 ml	2.00	0.00	0.33	18
pH (Lab)	pH Units	7.70	6.20	6.99	9
E. Cond.	µmhos	47.00	22.00	38.22	9
Turb.	JTU	3.00	1.00	2.00	7
Flow	CFS	0.05	0.01	0.02	9
Temp.	°C	6.50	3.00	5.08	6
TDS	mg/l	30.55	14.30	24.84	9
SAR	ratio	0.32	0.18	0.23	9
Fec. Strep.	cts/100 ml	--	--	--	0

1974-1975 Data

1974-1975

SITE NO. 1 (Reynolds at Snake)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	190.00	6.00	31.05	21
SiO_2	mg/l	49.90	10.50	35.29	21
Ortho P	mg/l	0.24	0.01	0.10	21
Total P	mg/l	6.90	0.06	0.65	21
Ammonia	mg/l	0.01	0.00	0.00	19
Nitrite	mg/l	0.04	0.00	0.01	21
Nitrate	mg/l	3.35	0.14	1.20	21
Organic-N	mg/l	2.36	0.15	0.52	19
BOD (5)	mg/l	--	--	--	0
DO	mg/l	11.00	1.00	8.11	14
Susp. Sed.	mg/l	2464.00	4.00	243.74	19
CO_3	mg/l	6.00	0.00	0.29	21
HCO_3	mg/l	452.10	88.47	276.13	21
Cl	mg/l	44.31	4.96	24.76	21
SO_4	mg/l	398.65	24.98	186.18	21
Ca	mg/l	143.29	19.24	76.33	21
Mg	mg/l	39.39	5.84	22.14	21
Na	mg/l	157.70	16.78	78.87	21
K	mg/l	10.56	1.96	5.85	21
Coli. (T)	cts/100 ml	13400.00	30.00	2057.58	33
Coli. (F)	cts/100 ml	4550.00	0.00	559.06	33
pH (Lab)	pH Units	8.50	7.10	7.90	21
E. Cond.	µmhos	1436.00	206.00	813.86	21
Turb.	JTU	1100.00	1.00	72.55	20
Flow	CFS	--	--	--	0
Temp.	°C	17.50	0.00	9.45	20
TDS	mg/l	933.40	133.90	529.01	21
SAR	ratio	3.01	0.86	1.96	21
Fec. Strep.	cts/100 ml	21500.00	50.00	2273.55	22

1974-1975

SITE NO. 2 (Rattlesnake)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	167.00	7.00	33.00	20
SiO_2	mg/l	38.20	12.60	28.28	21
Ortho P	mg/l	0.27	0.00	0.07	21
Total P	mg/l	5.34	0.02	0.60	21
Ammonia	mg/l	0.06	0.00	0.00	19
Nitrite	mg/l	0.02	0.00	0.00	21
Nitrate	mg/l	0.65	0.02	0.19	21
Organic-N	mg/l	4.41	0.06	0.63	19
BOD (5)	mg/l	--	--	--	0
DO	mg/l	11.00	7.00	9.08	12
Susp. Sed.	mg/l	7492.00	4.00	626.20	20
CO_3	mg/l	13.20	0.00	1.19	21
HCO_3	mg/l	292.86	70.16	198.06	21
Cl	mg/l	54.59	3.54	24.29	21
SO_4	mg/l	273.77	14.41	115.94	21
Ca	mg/l	77.35	13.23	39.33	21
Mg	mg/l	30.15	4.38	16.29	21
Na	mg/l	137.01	11.26	67.99	21
K	mg/l	9.78	1.56	4.51	21
Coli. (T)	cts/100 ml	2000.00	0.00	333.69	32
Coli. (F)	cts/100 ml	750.00	0.00	104.34	32
pH (Lab)	pH Units	8.68	7.60	8.13	21
E. Cond.	µmhos	1003.00	151.00	593.86	21
Turb.	JTU	520.00	1.00	41.60	20
Flow	CFS	115.00	0.78	22.05	21
Temp.	°C	19.00	0.00	8.13	20
TDS	mg/l	651.95	98.15	386.01	21
SAR	ratio	4.14	0.69	2.16	21
Fec. Strep.	cts/100 ml	1800.00	0.00	229.60	20

1974-1975

SITE NO. 3 (Reynolds Outlet)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	151.00	7.00	33.68	25
SiO_2	mg/l	37.40	13.60	30.94	25
Ortho P	mg/l	0.22	0.01	0.08	25
Total P	mg/l	4.62	0.02	0.58	24
Ammonia	mg/l	0.02	0.00	0.00	25
Nitrite	mg/l	0.02	0.00	0.00	25
Nitrate	mg/l	0.97	0.05	0.28	25
Organic-N	mg/l	6.19	0.18	0.97	25
BOD (5)	mg/l	--	--	--	0
DO	mg/l	14.00	5.00	9.50	14
Susp. Sed.	mg/l	8690.00	0.00	695.56	18
CO_3	mg/l	10.20	0.00	0.61	25
HCO_3	mg/l	397.19	60.40	195.22	25
Cl	mg/l	53.53	2.13	18.90	25
SO_4	mg/l	264.17	10.09	92.03	25
Ca	mg/l	79.56	11.62	38.99	25
Mg	mg/l	34.04	3.04	14.28	25
Na	mg/l	142.53	8.74	56.90	25
K	mg/l	7.82	1.56	3.55	25
Coli. (T)	cts/100 ml	6500.00	20.00	612.57	37
Coli. (F)	cts/100 ml	864.00	0.00	139.78	37
pH (Lab)	pH Units	8.74	7.46	8.02	25
E. Cond.	µmhos	1157.00	128.00	519.44	25
Turb.	JTU	700.00	0.00	69.84	24
Flow	CFS	223.75	0.77	41.23	25
Temp.	°C	25.00	0.00	7.73	22
TDS	mg/l	752.05	83.20	337.63	25
SAR	ratio	3.80	0.55	1.78	25
Fec. Strep.	cts/100 ml	1160.00	4.00	354.58	24

1974-1975

SITE NO. 4 (Salmon Creek)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	166.00	7.00	86.50	2
SiO_2	mg/l	42.40	27.10	34.75	2
Ortho P	mg/l	0.27	0.10	0.18	2
Total P	mg/l	4.83	0.12	2.47	2
Ammonia	mg/l	0.00	0.00	0.00	2
Nitrite	mg/l	0.00	0.00	0.00	2
Nitrate	mg/l	0.23	0.01	0.12	2
Organic-N	mg/l	5.60	0.20	2.90	2
BOD (5)	mg/l	--	--	--	0
DO	mg/l	--	--	--	0
Susp. Sed.	mg/l	--	--	--	0
CO_3	mg/l	0.00	0.00	0.00	2
HCO_3	mg/l	179.38	58.57	118.97	2
Cl	mg/l	6.38	0.71	3.54	2
SO_4	mg/l	13.93	1.44	7.68	2
Ca	mg/l	31.06	9.22	20.14	2
Mg	mg/l	12.16	3.65	7.90	2
Na	mg/l	18.85	5.29	12.07	2
K	mg/l	2.74	2.35	2.54	2
Coli. (T)	cts/100 ml	8050.00	0.00	722.00	33
Coli. (F)	cts/100 ml	4160.00	0.00	211.00	33
pH (Lab)	pH Units	8.28	7.63	7.95	2
E. Cond.	µmhos	302.00	103.00	202.50	2
Turb.	JTU	560.00	2.00	281.00	2
Flow	CFS	26.56	0.89	13.72	2
Temp.	^{o}C	3.00	3.00	3.00	1
TDS	mg/l	196.30	66.95	131.62	2
SAR	ratio	0.73	0.37	0.55	2
Fec. Strep.	cts/100 ml	2220.00	0.00	291.86	21

1974-1975

SITE NO. 5 (Lower Reynolds)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	128.00	2.00	34.25	28
SiO_2	mg/l	41.80	12.80	30.40	28
Ortho P	mg/l	0.28	0.04	0.08	28
Total P	mg/l	3.13	0.06	0.57	27
Ammonia	mg/l	0.12	0.00	0.01	27
Nitrite	mg/l	0.02	0.00	0.00	27
Nitrate	mg/l	0.55	0.02	0.16	28
Organic-N	mg/l	4.32	0.19	1.09	26
BOD (5)	mg/l	--	--	--	0
DO	mg/l	10.00	7.00	8.46	14
Susp. Sed.	mg/l	11044.00	2.00	700.44	19
CO_3	mg/l	0.00	0.00	0.00	27
HCO_3	mg/l	417.94	55.52	199.71	27
Cl	mg/l	36.16	1.77	13.81	27
SO_4	mg/l	235.35	8.65	80.96	27
Ca	mg/l	84.37	10.42	39.03	27
Mg	mg/l	26.02	3.16	12.01	27
Na	mg/l	138.39	8.05	52.49	27
K	mg/l	13.30	1.56	4.17	27
Coli. (T)	cts/100 ml	3000.00	20.00	531.58	38
Coli. (F)	cts/100 ml	2800.00	0.00	255.26	38
pH (Lab)	pH Units	8.32	7.37	7.94	28
E. Cond.	µmhos	1110.00	116.00	476.18	28
Turb.	JTU	360.00	1.00	71.96	26
Flow	CFS	163.99	0.79	37.75	27
Temp.	°C	25.00	1.00	8.33	23
TDS	mg/l	721.50	75.40	309.51	28
SAR	ratio	3.62	0.56	1.68	27
Fec. Strep.	cts/100 ml	4620.00	5.00	613.88	24

1974-1975

SITE NO. 6 (Macks Creek Weir)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	84.00	26.00	54.33	3
SiO_2	mg/l	41.90	25.00	31.13	3
Ortho P	mg/l	0.24	0.06	0.16	3
Total P	mg/l	4.65	0.07	2.36	2
Ammonia	mg/l	0.00	0.00	0.00	3
Nitrite	mg/l	0.00	0.00	0.00	3
Nitrate	mg/l	0.30	0.02	0.18	3
Organic-N	mg/l	2.43	0.18	1.25	3
BOD (5)	mg/l	--	--	--	0
DO	mg/l	--	--	--	0
Susp. Sed.	mg/l	--	--	--	0
CO_3	mg/l	0.00	0.00	0.00	3
HCO_3	mg/l	288.59	56.74	134.84	3
Cl	mg/l	81.18	1.77	28.36	3
SO_4	mg/l	499.52	9.13	172.75	3
Ca	mg/l	149.90	10.82	57.31	3
Mg	mg/l	51.30	3.53	19.49	3
Na	mg/l	116.78	7.59	44.44	3
K	mg/l	5.08	1.96	3.00	3
Coli. (T)	cts/100 ml	7200.00	10.00	679.00	15
Coli. (F)	cts/100 ml	2264.00	0.00	236.00	15
pH (Lab)	pH Units	8.11	7.69	7.87	3
E. Cond.	µmhos	1487.00	119.00	577.67	3
Turb.	JTU	470.00	1.00	237.00	3
Flow	CFS	45.67	0.15	18.78	3
Temp.	°C	3.00	2.50	2.75	2
TDS	mg/l	966.55	77.35	375.48	3
SAR	ratio	2.10	0.51	1.07	3
Fec. Strep.	cts/100 ml	42.00	16.00	27.67	3

1974-1975

SITE NO. 7 (Upper Macks)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	1750.00	5.00	232.73	13
Fecal Coli.	cts/100 ml	540.00	0.00	67.37	13
Fecal Strep.	cts/100 ml	10540.00	0.00	1296.88	13

SITE NO. 8 (Cottle Creek)

Total Coli.	cts/100 ml	2170.00	0.00	390.11	16
Fecal Coli.	cts/100 ml	950.00	0.00	116.92	16
Fecal Strep.	cts/100 ml	1490.00	2.00	170.36	16

SITE NO. 9 (Lower Murphy)

Total Coli.	cts/100 ml	260.00	240.00	250.00	2
Fecal Coli.	cts/100 ml	170.00	0.00	85.93	2
Fecal Strep.	cts/100 ml	180.00	120.00	150.21	2

SITE NO. 10 (Upper Murphy)

Total Coli.	cts/100 ml	2650.00	40.00	935.73	6
Fecal Coli.	cts/100 ml	420.00	0.00	167.81	6
Fecal Strep.	cts/100 ml	300.00	10.00	125.38	6

SITE NO. 11 (Upper Farrot Creek)

Total Coli.	cts/100 ml	2910.00	200.00	1463.22	3
Fecal Coli.	cts/100 ml	1164.00	300.00	808.68	3
Fecal Strep.	cts/100 ml	780.00	89.00	320.73	3

SITE NO. 12 (Boston Ditch)

Total Coli.	cts/100 ml	860.00	180.00	510.32	4
Fecal Coli.	cts/100 ml	370.00	240.00	305.61	4
Fecal Strep.	cts/100 ml	180.00	10.00	120.90	4

SITE NO. 13 (Upper Salmon)

Total Coli.	cts/100 ml	2900.00	5.00	345.52	15
Fecal Coli.	cts/100 ml	2790.00	0.00	229.61	15
Fecal Strep.	cts/100 ml	1260.00	0.00	175.07	15

1974-1975

SITE NO. 14 (Tyson)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	1940.00	20.00	466.77	33
Fecal Coli.	cts/100 ml	552.00	0.00	127.21	33
Fecal Strep.	cts/100 ml	2750.00	8.00	350.28	21

SITE NO. 15 (Nettleton)

Total Coli.	cts/100 ml	6750.00	0.00	739.66	30
Fecal Coli.	cts/100 ml	1664.00	0.00	202.81	39
Fecal Strep.	cts/100 ml	2180.00	0.00	340.13	26

SITE NO. 16 (Gabica)

Total Coli.	cts/100 ml	1120.00	0.00	146.03	32
Fecal Coli.	cts/100 ml	560.00	0.00	54.14	32
Fecal Strep.	cts/100 ml	740.00	0.00	91.44	20

1974-1975

SITE NO. 17 (Tollgate)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	154.00	3.00	22.17	23
SiO_2	mg/l	31.60	10.30	25.54	24
Ortho P	mg/l	0.09	0.01	0.04	24
Total P	mg/l	3.75	0.04	0.39	23
Ammonia	mg/l	0.01	0.00	0.00	23
Nitrite	mg/l	0.00	0.00	0.00	24
Nitrate	mg/l	0.47	0.01	0.12	24
Organic-N	mg/l	4.58	0.10	0.66	23
BOD (5)	mg/l	--	--	--	0
DO	mg/l	10.00	7.00	8.42	13
Susp. Sed.	mg/l	10000.00	0.00	772.26	19
CO_3	mg/l	0.00	0.00	0.00	24
HCO_3	mg/l	123.86	32.95	79.21	24
Cl	mg/l	1.77	0.00	0.83	24
SO_4	mg/l	5.28	0.48	2.88	24
Ca	mg/l	20.44	6.41	14.27	24
Mg	mg/l	8.27	1.70	5.04	24
Na	mg/l	8.28	2.99	6.04	24
K	mg/l	1.96	0.78	1.75	24
Coli. (T)	cts/100 ml	1840.00	0.00	47.00	37
Coli. (F)	cts/100 ml	400.00	0.00	247.57	37
pH (Lab)	pH Units	8.34	7.28	7.82	24
E. Cond.	µmhos	199.00	55.00	135.83	24
Turb.	JTU	280.00	1.00	37.87	23
Flow	CFS	165.30	0.97	30.75	24
Temp.	^oC	22.00	0.50	7.85	23
TDS	mg/l	129.35	35.75	88.29	24
SAR	ratio	0.40	0.27	0.35	24
Fec. Strep.	cts/100 ml	540.00	0.00	51.67	24

1974-1975

SITE NO. 18 (Below Dobson)

Parameter	Unit	Maximum	Minimum	Average	Cases
Total Coli.	cts/100 ml	3860.00	0.00	424.81	34
Fecal Coli.	cts/100 ml	475.00	0.00	80.11	34
Fecal Strep.	cts/100 ml	730.00	0.00	107.76	21

1974-1975

SITE NO. 19 (Above Dobson)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	36.00	11.00	23.50	2
SiO_2	mg/l	23.50	20.00	21.75	2
Ortho P	mg/l	0.41	0.08	0.24	2
Total P	mg/l	3.34	3.34	3.34	1
Ammonia	mg/l	0.00	0.00	0.00	2
Nitrite	mg/l	0.00	0.00	0.00	2
Nitrate	mg/l	0.37	0.22	0.29	2
Organic-N	mg/l	0.88	0.33	0.60	2
BOD (5)	mg/l	--	--	--	0
DO	mg/l	--	--	--	0
Susp. Sed.	mg/l	--	--	--	0
CO_3	mg/l	0.00	0.00	0.00	2
HCO_3	mg/l	67.72	49.42	58.57	2
Cl	mg/l	1.42	0.71	1.06	2
SO_4	mg/l	1.92	0.96	1.44	2
Ca	mg/l	11.62	9.62	10.62	2
Mg	mg/l	4.50	2.92	3.71	2
Na	mg/l	5.75	4.14	4.94	2
K	mg/l	1.56	1.17	1.37	2
Coli. (T)	cts/100 ml	3820.00	0.00	335.59	34
Coli. (F)	cts/100 ml	800.00	0.00	85.15	34
pH (Lab)	pH Units	7.76	7.64	7.70	2
E. Cond.	µmhos	123.00	83.00	103.00	2
Turb.	JTU	70.00	22.00	46.00	2
Flow	CFS	44.44	27.99	36.21	2
Temp.	°C	0.50	0.50	0.50	1
TDS	mg/l	79.95	53.95	66.95	2
SAR	ratio	0.36	0.30	0.33	2
Fec. Strep.	cts/100 ml	520.00	0.00	67.52	21

1974-1975

SITE NO. 20 (Dobson)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	50.00	3.00	11.22	23
SiO_2	mg/l	33.30	10.90	26.45	22
Ortho P	mg/l	0.24	0.01	0.05	23
Total P	mg/l	0.58	0.03	0.12	22
Ammonia	mg/l	0.01	0.00	0.00	22
Nitrite	mg/l	0.01	0.00	0.00	23
Nitrate	mg/l	0.43	0.02	0.12	23
Organic-N	mg/l	1.02	0.12	0.27	22
BOD (5)	mg/l	--	--	--	0
DO	mg/l	10.00	4.00	8.09	11
Susp. Sed.	mg/l	1214.00	0.00	98.39	18
CO_3	mg/l	0.00	0.00	0.00	22
HCO_3	mg/l	114.09	42.10	76.05	23
Cl	mg/l	1.42	0.00	0.68	23
SO_4	mg/l	5.28	0.00	2.26	23
Ca	mg/l	20.44	7.62	14.13	23
Mg	mg/l	7.05	1.46	4.45	23
Na	mg/l	7.59	3.45	5.63	23
K	mg/l	1.96	0.78	1.26	23
Coli. (T)	cts/100 ml	2500.00	0.00	447.35	34
Coli. (F)	cts/100 ml	1215.00	0.00	176.35	34
pH (Lab)	pH Units	8.18	7.10	7.81	23
E. Cond.	µmhos	211.00	70.00	128.43	23
Turb.	JTU	90.00	1.00	12.91	22
Flow	CFS	33.33	0.23	6.39	23
Temp.	°C	18.00	0.00	6.47	23
TDS	mg/l	137.15	45.50	83.48	23
SAR	ratio	0.40	0.27	0.34	23
Fec. Strep.	cts/100 ml	475.00	0.00	80.43	21

1974-1975

SITE NO. 21 (Democrat)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	55.00	3.00	10.71	21
SiO_2	mg/l	22.90	7.50	17.83	22
Ortho P	mg/l	0.12	0.01	0.03	22
Total P	mg/l	1.41	0.02	0.16	22
Ammonia	mg/l	0.01	0.00	0.00	21
Nitrite	mg/l	0.01	0.00	0.00	22
Nitrate	mg/l	0.68	0.02	0.18	22
Organic-N	mg/l	1.42	0.09	0.27	21
BOD (5)	mg/l	--	--	--	0
DO	mg/l	11.00	7.00	9.00	12
Susp. Sed.	mg/l	906.00	0.00	76.72	18
CO_3	mg/l	0.00	0.00	0.00	22
HCO_3	mg/l	54.91	20.13	40.49	22
Cl	mg/l	1.06	0.00	0.26	22
SO_4	mg/l	9.61	0.96	5.11	22
Ca	mg/l	12.83	4.41	9.13	22
Mg	mg/l	2.67	0.61	1.84	22
Na	mg/l	5.29	2.76	4.26	22
K	mg/l	1.17	0.39	0.76	22
Coli. (T)	cts/100 ml	1460.00	0.00	151.59	32
Coli. (F)	cts/100 ml	270.00	0.00	20.31	32
pH (Lab)	pH Units	8.19	6.72	7.58	22
E. Cond.	µmhos	108.00	31.00	78.77	22
Turb.	JTU	140.00	1.00	14.76	21
Flow	CFS	9.36	0.01	0.82	22
Temp.	°C	18.00	0.00	5.98	22
TDS	mg/l	70.20	20.15	51.20	22
SAR	ratio	0.41	0.31	0.34	22
Fec. Strep.	cts/100 ml	280.00	0.00	53.70	20

1974-1975

SITE NO. 22 (Reynolds Mtn. Weir)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	30.00	3.00	8.44	18
SiO_2	mg/l	25.60	6.10	19.89	19
Ortho P	mg/l	0.04	0.00	0.02	19
Total P	mg/l	0.12	0.03	0.05	19
Ammonia	mg/l	0.00	0.00	0.00	17
Nitrite	mg/l	0.00	0.00	0.00	19
Nitrate	mg/l	0.41	0.02	0.08	19
Organic-N	mg/l	0.37	0.11	0.20	17
BOD (5)	mg/l	--	--	--	0
DO	mg/l	9.00	5.00	7.20	10
Susp. Sed.	mg/l	11494.00	0.00	770.53	15
CO_3	mg/l	0.00	0.00	0.00	19
HCO_3	mg/l	46.98	12.81	24.15	19
Cl	mg/l	1.42	0.00	0.17	19
SO_4	mg/l	5.28	0.48	1.85	19
Ca	mg/l	10.22	2.61	4.40	19
Mg	mg/l	7.42	0.24	1.32	19
Na	mg/l	5.06	1.84	3.28	19
K	mg/l	1.56	0.39	0.68	19
Coli. (T)	cts/100 ml	5150.00	0.00	838.16	31
Coli. (F)	cts/100 ml	3000.00	0.00	353.68	31
pH (Lab)	pH Units	7.93	6.62	7.20	19
E. Cond.	µmhos	84.00	25.00	43.79	19
Turb.	JTU	16.00	3.00	7.67	18
Flow	CFS	4.06	0.01	0.48	19
Temp.	°C	23.00	0.00	7.80	19
TDS	mg/l	54.60	16.25	28.46	19
SAR	ratio	0.46	0.27	0.36	19
Fec. Strep.	cts/100 ml	1040.00	0.00	134.36	22

1974-1975

SITE NO. 23 (Reynolds Mtn. Spring)

Parameter	Unit	Maximum	Minimum	Average	Cases
COD	mg/l	7.00	0.00	1.73	15
SiO_2	mg/l	12.10	4.00	10.45	15
Ortho P	mg/l	0.02	0.00	0.01	15
Total P	mg/l	0.03	0.01	0.02	15
Ammonia	mg/l	0.01	0.00	0.00	13
Nitrite	mg/l	0.02	0.00	0.00	15
Nitrate	mg/l	2.06	0.44	1.44	15
Organic-N	mg/l	0.15	0.04	0.09	13
BOD (5)	mg/l	--	--	--	0
DO	mg/l	10.00	8.00	8.77	11
Susp. Sed.	mg/l	30.00	0.00	6.92	12
CO_3	mg/l	0.00	0.00	0.00	14
HCO_3	mg/l	10.98	6.71	8.63	14
Cl	mg/l	0.71	0.00	0.18	14
SO_4	mg/l	9.61	0.48	1.54	14
Ca	mg/l	4.41	2.40	3.65	14
Mg	mg/l	0.61	0.12	0.41	14
Na	mg/l	2.30	1.38	1.71	14
K	mg/l	0.78	0.00	0.45	14
Coli. (T)	cts/100 ml	16.00	0.00	2.50	20
Coli. (F)	cts/100 ml	4.00	0.00	0.30	20
pH (Lab)	pH Units	7.72	6.24	6.78	15
E. Cond.	µmhos	45.00	25.00	33.93	15
Turb.	JTU	4.00	0.00	1.79	14
Flow	CFS	0.05	0.01	0.02	15
Temp.	°C	6.00	0.00	4.13	15
TDS	mg/l	79.25	16.25	22.06	15
SAR	ratio	0.30	0.17	0.23	14
Fec. Strep.	cts/100 ml	2.00	0.00	0.22	9

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